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TELEPHONE ENGINEER

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VOL. XXIII *Chicago, January, 1920.* *No. 1*

The Postmaster General's Report

FOR the large amount of space occupied in this number by the final report of the postmaster general to the president, on the subject of governmental control of communication systems, we feel that no apology is necessary. Of course it is, in one sense, already ancient history. But it is the official record of the most extraordinary event in such history as the telephone industry, still young, can claim. It is history that is not likely to repeat itself. Government ownership, which has hovered in the background of telephone service through all its career, has had its experminent. Now, we believe, it is farther away than it ever has been.

President McKinnon of the United States Independent Telephone Association urges telephone men to study especially the paragraph of the report entitled "Basis for Determining Just Compensation to Owners of Telephone Properties." Only forty operating companies made contracts with the government during the war; and to all other companies the postmaster general is now awarding compensation under the terms there set forth.

Telephone operating is back under the control of the states. As the association officer says, "Whether the companies will remain under the state control will depend very largely upon whether that control is liberal and efficient; whether it operates to the advantage of both the public and the companies; whether it results in high-class telephone service to the country."

Most of the state regulatory bodies have shown, and are showing, a disposition to give the most patient consideration to the needs of the industry, and not to hold it responsible for the clash of authority that arose from the announcement of "Burleson rates." Properly administered state control has proven quite satisfactory, and it is the part of good judgment and good business to preserve all possible harmony in the necessary relations with those state bodies, and to coöperate with them in a sincere effort to achieve the results desired.

The plight of he railroads, the only other utility whose war experience paralleled that of the telephone, serves as a gauge of the good fortune so far enjoyed by the communication systems of the country. That the wise and conservative management which has always been a feature of this industry is assurance of a continuance of that good fortune through the coming year and beyond, is our sincere conviction.

The Home Rule Idea

AMONG organized municipalities the idea of home rule of public utilities dies hard. Most of the time there are cases in court, somewhere, in which one city or another vigorously protests because it is not permitted to dictate the rates and rules of service corporations within its gates. Viewed superficially, their case appears to have some merit. The companies use the city's streets and employ the city's residents to serve the city's people and industries. The state commission probably sits in another city, perhaps viewed by the interested community in no friendly manner. The resentment manifested may not all be for political effect. There may be some sincerity in it.

But if any evidence is really needed that state control is the wiser, and that home rule would be an actual calamity, these very cases supply it in abundant measure. For always the municipality appears in court not as the champion of equitable rates and just measures, but as the bitter antagonist of the utility, determined to secure a bargain from it no matter at what cost to its investors or management. Rare indeed is the city official who gives any consideration whatever to the needs of the utility. The whole purpose of municipal handling of utilities is to be able to offer the people the lowest possible rate in the guise of a hard-won prize. The louder the outcry of the utility, the greater appears the triumph of the city in what is, to all intents and purposes, a battle for public opinion.

No operating manager inclined to honest dealing would willingly consent to go back to the old political method of rate making, after reasonable experience with the scientific and equitable system of the state commissions. In most states the legislatures have made their purpose plain, and the commissions are sure of their ground in the court. They are equally sure of their position in the eyes of all thinking men who have observed the ways of the average municipality.

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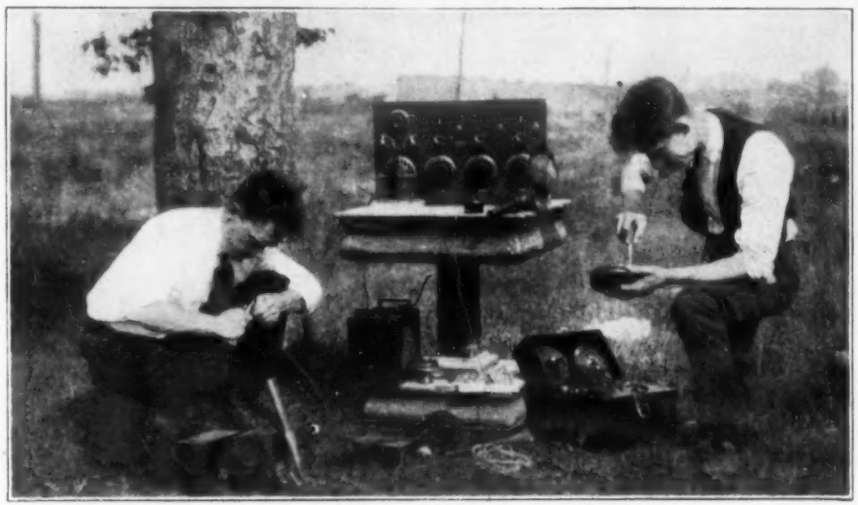
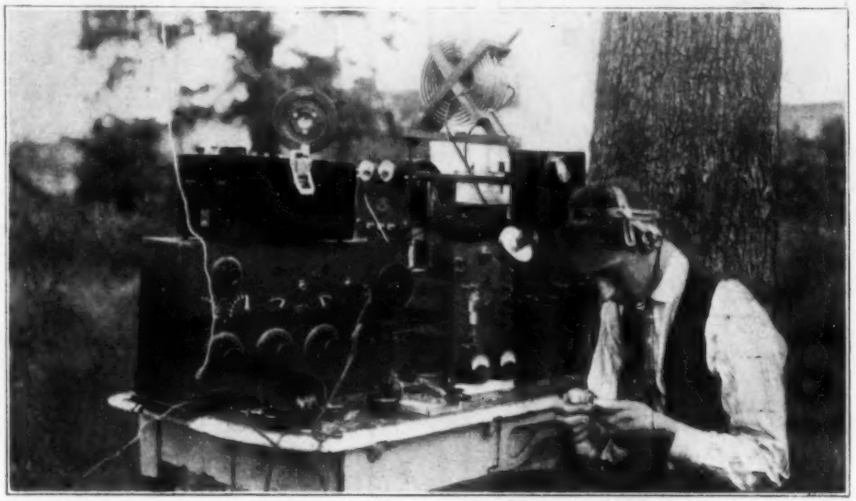
Putting Some of the Finishing Touches to the Transmitting Set and Connecting Up the Tree.

Shows Rear View of the Receiving Apparatus and Placing Vacuum Bulbs in Position.

Using Trees as Wireless-Telephone Antenna. The Complete Apparatus in Working Order.



Assembling the Apparatus for the Tree Wireless.



The Tree Set in Operation. Listening for the N. A. A. Time Signals.

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WIRELESS-TELEPHONE AMATEURS FOLLOW EXAMPLE OF GENERAL SQUIER, AND USE TREES TO TRANSMIT AND RECEIVE MESSAGES.

Telephone Repeaters

Presented at a Joint Meeting of the American Institute of Electrical Engineers and the Institute of Radio Engineers

By BANCROFT GHERARDI and FRANK B. JEWETT

ABSTRACT OF PAPER

In this paper the authors have endeavored to set forth briefly but clearly the history of the research and development work which has led up to the final production of successful telephone repeaters. The various forms of amplifiers which have been suggested are described and their possibilities and limitations pointed out. The essential properties of repeater networks together with the necessary line conditions for successful repeater operation are described and illustrated. Tandem operation of repeater is discussed as is also the use of repeaters in four-wire circuits. Illustrations are given showing a few of the more important repeater installations now in regular commercial service in the United States.

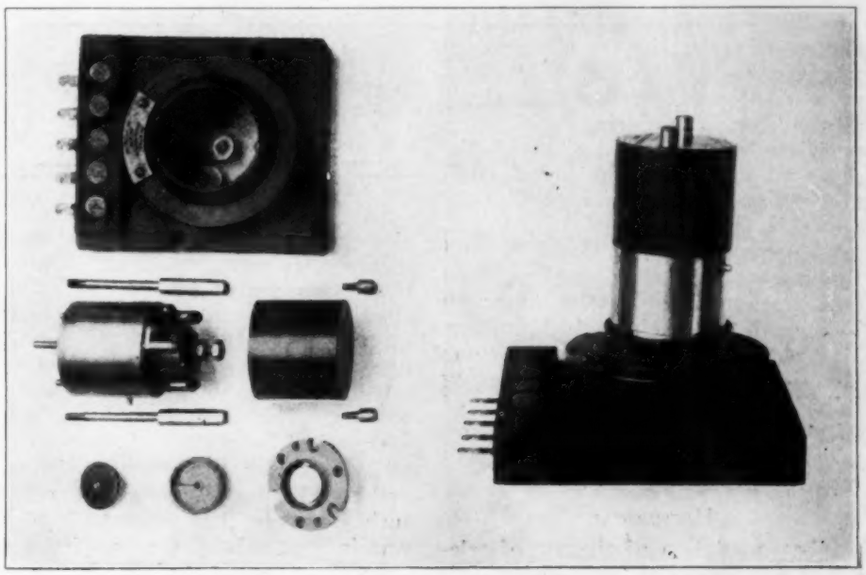
DURING the past ten years developments in the design and construction of telephone amplifiers, or telephone repeaters as they are more universally called, and in the art of their application to all forms of telephone circuits have progressed to such an extent as to justify the presentation to the American Institute of Electrical Engineers of a comprehensive paper which shall cover not only the earlier efforts but the present state of development.

As indicated below, the idea of one or more repeaters inserted in a line for the purpose of reinforcing from some local source of energy the weakened current from the sending station is older than the telephone itself. In telephony innumerable attempts by a large number of investigators have gone on continuously almost from the inception of the telephone in an effort to extend the range of telephonic speech through the utilization of energy applied to the telephone line at a point or points between the transmitting and receiving stations. While the net result of all this work is, of course, the state of the art as we now have it, a survey of the earlier developments in the light of present-day knowledge discloses in striking fashion the fact that, unknown to the investigators, the early attempts were destined not to succeed where success was measured by the development of a practical device which would give satisfactory results on a regular two-way telephone circuit.

We know now that the final successful development and application of the telephone repeater had to wait not only for the slow accumulation of comprehensive knowledge concerning all the factors which govern the successful transmission of speech electrically over wires and of the intricate relation of circuits and apparatus to produce desired results with the maze of frequencies involved in speech, but also on developments in physical science which were in themselves quite foreign to the specific realm of telephony. For these reasons the work of the earlier investigators, ingenious though it was, was for years foredoomed to failure by factors over which they had no control and of which, in many cases, they had no knowledge even. In the light of what we now know, much of this early work appears almost impossibly successful and attests to the ingenuity and resourcefulness of the men who conducted it.

Another thing which the final successful development and extensive application of the telephone repeater indicates with striking clarity is the fact that a complete solution of the problem was made possible only by the existence of a great unified engineering and research department, such as that maintained by the Bell System. The elements involved and the multiplicity of detail to be worked out and correlated were far beyond the limitations of any single individual or any limited organization. The best that mathematics, physics, chemistry, engineering, manufacturing and operation could supply were needed for the solution. Further, if the solution were to be obtained in a reasonable time it was essential that the efforts of the experts in all of these fields must be directed in a cooperative attack on the main problem. With the growth of fundamental research groups of highly trained scientists in the engineering department of the Bell System the means for attacking the elusive repeater problem in comprehensive fashion became available and progress toward success became certain and rapid. The loose ends of discrete and desultory researches were gathered in, past and present work scrutinized and the attack directed from a foundation of certain knowledge not theretofore available.

The wonderful success which has attended the work and which has started what bids fair to be a revolution in the entire scheme of telephonic transmission should be a



The Cartridge-Type Repeater of Fig. 9; Left, Dismantled; Right, Assembled.

source of gratification to American electrical engineers, to whom more than to any others have been due the other wonderful telephone developments of the past.

In discussing the earlier work on telephone repeaters and that which led up to the first successful device, the authors have not attempted even to enumerate the large number of in-

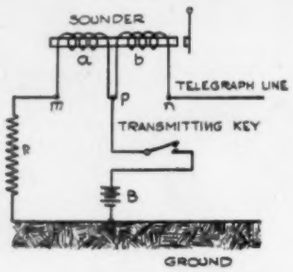


Fig. 1.

vestigators, much less to allocate credit among them. The names mentioned are those of the men who stand out most conspicuously and the fact that many of them are employes of the Bell system is not remarkable, since it was the largest single agency consistently at work on all problems concerning telephone development. In a complex art which has been vigorously worked for nearly fifty years, it is inevitable that great numbers of patents should have been taken out on all conceivable kinds of devices and systems. Many of these are inherently worthless, while others contain elements of value, although not in themselves disclosing complete workable arrangements. While, therefore, no single invention has solved the repeater problem in its entirety, it is interesting to note that all of the inventions which make possible the successful application of telephone repeaters would be complete without mention of the fact that throughout all the later years, during which progress has been certain and rapid, the principal credit for the broad engineering and commercial results obtained is due to Colonel J. J. Carty, past president of the Institute and for many years chief engineer and now vice president of the American Telephone and Telegraph Company. To Colonel Carty more than any one else is due the credit of having brought about that co-ordination of all of the elements mentioned above which was vital to the ultimate success of the undertaking.

Historical

The foundation of the art of telephony by Alexander Graham Bell followed by almost fifty years that institution of the sister art of telegraphy which was based on the discoveries of Faraday, Ampere, Volta, and Henry. It was inevitable, therefore, that efforts to extend the range of telephonic communication should be influenced by earlier and successful efforts in telegraphic communication. As telegraphic operation was attempted between more widely separated stations it was found that the attenuated currents were insufficient to operate the recording mechanism. to obviate this limitation Morse introduced at the receiving station a local source of energy which supplied current to the recording mechanism but was controlled by the received signals through the medium of an electromagnetic relay.

In this invention was the principle necessary for an indefinite extension of the possible range of communication since the local source might supply current to another stretch of line. It is a curious bit of history that this application was not utilized for several years during which transmission over long distances was accomplished by manual instead of automatic repetition at the intermediate stations.

The delay in this natural development was due to the fact that the relay of Morse, although it was a repeater, was a one-way device since it was actuated only by currents arriving from one of the two telegraph stations on either side of it. It required the use of two such repeater

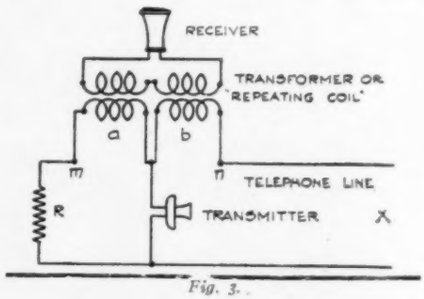


Fig. 3.

elements and of a circuit arrangement to convert a one-way into a two-way repeater station. Of these circuit arrangements one of the earliest was that of Varley. During the next few years duplex repeaters received considerable attention from inventors. The differentiation, however, which seems so obvious to us today, between the repeater element and the circuit arrangement by which such elements may operate duplex, was infrequently if ever emphasized.

In the extension of the range of telephony by the use of repeaters the duplex feature was even more essential than in telegraphy. The problem was complicated not only by the inherited confusion between element and circuit but also by the greater importance of the third factor in such operation, namely, the lines on either side of the repeating station.

The necessity for distinguishing between these three factors of repeat-

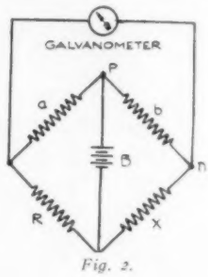


Fig. 2.

ing element, repeater circuit, and lines was early recognized by the engineers of the Bell System. The exact and quantitative relationships between them have been adequately expressed for about a decade. In our discussion of the matter in hand we shall follow, therefore, the logical order which results from this differentiation and treat these factors separately in the above order. Before undertaking their more detailed exposition it may be well to vivify their individuality by the consideration of the concrete case illustrated in Figs. 1 to 5 inclusive.

A principle, which is familiarly known by its direct-current application in the Wheatstone bridge, has proved most fertile in the formation of duplex circuits. Thus in Fig. 1 we have an early method of duplex telegraphy, which is obviously reducible to the simple bridge circuit of Fig. 2. If a and b are equal then, provided also R is equal to X, the battery B will cause no difference of potential between m and n and hence no current through the galvanometer in the case of Fig 2 and no resultant magnetism in the sounder of Fig. 1.

The same principle is applicable to the duplex operation of a telephone line as is seen in Fig. 3, where the sounder and the key of Fig. 1 are replaced respectively, by a receiver and a transmitter. If the resistance R is not equal to X, the impedance of the telephone line, then, the duplex set is not entirely "anti-side tone" since the operation of the transmitter causes some current in the receiver. The amount of current through the receiver and hence the

motion of its diaphragm depends both upon the current from the transmitter and upon the amount of unbalance in the bridge which is occasioned by the inequality of R and X.

If we dispose the transmitter and the receiver as in Fig. 4, allowing any sound from the latter to actuate the transmitter, then we may obtain what is termed a "howling set." The mere jarring of the carbon button due to bringing the instruments into juxtaposition will result in a current from the transmitter and hence, if R and X are not equal, in some current in the receiver. The consequent motion of the receiver diaphragm causes a new disturbance of the carbon of the transmitter and this in turn causes a new impulse of current through the receiver itself. If the combination of receiver and transmitter is sufficiently sensitive this sequence of event may perpetuate itself and result in a steady tone, the frequency of which is determined by the electrical and mechanical characteristics of the system. The energy for such steady vibrations of the diaphragm is, of course, obtained from the battery associated with the transmitter. (For purposes of simplicity the battery is not shown in Figs. 3 and 4. It may be either a battery associated locally with the transmitter or one at the distant central office.)

From this illustration of the "howling set" the importance of line balance may be seen, for the combination of receiver and transmitter constitutes a repeater element. The element may

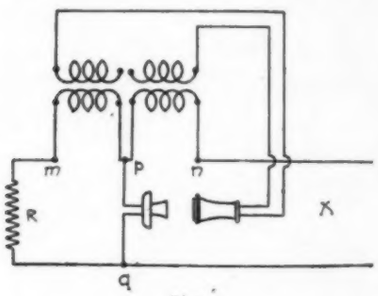


Fig. 4.

more conveniently be symbolized as in Fig. 5 where the resistance, R of Fig. 4, has been replaced by a telephone line. In this last form of the bridge we may recognize the three factors mentioned above. The repeating elements has input terminals *1, 2* and output terminals *3, 4*. It is associated with the lines on either side by the bridge circuit $m\ n\ q\ q$ in such a manner as to repeat telephone conversations in either direction. Thus voice currents originating at a station on the east line are impressed on the terminals *1, 2* of the element through the action of the transformer. The resulting output from terminals *3, 4* is then transmitted equally to the east, where it is received as side tone by

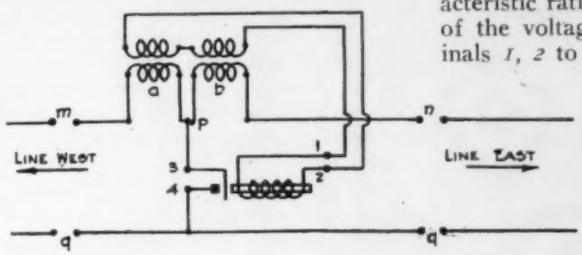


Fig. 5.

the speaker, and to the west, where it is usefully received by the distant auditor. Further details of this operation will be considered later. We may, however, note that if the unbalance between the lines east and west exceeds certain magnitude, which depends upon the sensitiveness of the element, then the operation is that of the howling set. Under these conditions the repeater is said to "sing," for it will transmit in both directions a strong steady tone which renders telephonic communication impossible.

The difficulty introduced by this possibility of singing was not serious in the early days of the development of telephone repeaters and only became so with the invention of more sensitive elements. In fact in the very early days the difficulty was to obtain an element of sufficient sensitiveness. What sort of conditions must be met may be illustrated by the fact that the current at the transmitting terminal of a long line is only a matter of 2 or 3 milliamperes. In transmission over the line the current is constantly attenuated so that at the receiving terminal it may be only 3 or 4 hundredths of its original magnitude. Such small currents required greater precision of design than was appreciated by many of the early inventors, although as early as 1888 one of the Bell engineers, E. H. Lyons, had constructed a repeater which would amplify such small currents.

THE REPEATER ELEMENT

Before considering further these early designs we may well list the operating requirements for a successful repeater element. In so doing we shall not be concerned with the physical principles upon which the device operates. To all present intents and purposes we are concerned only with pairs of terminals *1, 2* and *3, 4* of an enclosed and unknown electrical network as illustrated in Fig. 6. If we subject such a hidden element to electrical measurement with alternating current we may obtain, for each frequency which we use, several characteristic ratios. Thus, from the ratio of the voltage impressed upon terminals *1, 2* to the resulting current we obtain the impedance of that circuit and similarly for the circuit of terminals *3, 4*. We obtain also a mutual impedance by taking the ratio of the voltage produced in the circuit *3, 4* to the current in the circuit *1, 2*. Similarly, there may be measured the mutual impedance in the opposite direction. In case one only of the mutual impedances is zero, that is, that no voltage is produced on one side when a current is flowing in the other, we speak of the device as having a "unilateral mutual impedance." Of the repeaters which we have found best adapted to telephony all are of this unilateral type. The requirements which must be met are identical whether the device is bilateral or unilateral but they may be more conveniently stated in terms of the unilateral type, of which the receiver-transmitter (or mechanical form) shown in Figs. 4 and 5 is a simple illustration. These requirements are:

1. The unilateral mutual impedance must be independent of the amplitude of the impressed current, within the range required for telephone transmission. In other words, there must be a linear relation between the output voltage and the input current of the repeater, in which case the output is directly proportional to the input. If this condition is not met there will appear in the output one or more harmonics of the impressed alternating voltage.

1a. The input impedances of the element must be similarly independent of the impressed voltage or else distortion will occur.

2. The unilateral mutual impedance must be independent of the frequency of the impressed voltage within the range required for the transmission of the human voice. If this condition is not met the various overtones in such a complex sinusoidal current as is initiated by a voice will not be faithfully reproduced in their proper proportions.

2a. The input impedance of the element should be independent of the frequency of the impressed voltage or else it should be the same function of the frequency as is the impedance of the telephone line to which it is to be connected. If this condition is not met a distortion, destructive of good quality, may be introduced. In this case the voltage actuating the repeater is not that which the telephone line would impress upon another similar line but is greater or less by a

Fig. 6.

factor which depends upon the frequency. It is not sufficient that the element repeat accurately its input but it is also requisite that its input circuit received from the telephone line without distortion.

2b. The output impedance of the element should be similarly independent of the frequency or else properly related to the impedance of a telephone line so that the line may receive without distortion the output of the repeater.

3. The element must give amplification; that is, ignoring the energy sources which may be associated with or be parts of the element, the efficiency as measured by the ratio of output and input energies of telephone currents must be greater than unity. For example in the case of the mechanical element, which was pictured above, the energy is supplied by the battery associated with the carbon button. We are concerned at present only with its efficiency for transferring telephone variations from terminals *1*, *2* to terminals *3*, *4*. How much greater than 100 per cent this efficiency must be will depend, obviously, upon costs and other engineering factors. A repeating element adaptable to our telephone plant may well be expected to give an energy amplification such that telephone currents, which have been attenuated by about twenty miles of standard cable, will be restored to their original values by its action. In telephone parlance "the element should give a gain of about twenty miles." Since by transmission through twenty miles of standard cable both the current and voltage would be attenuated to about one-eighth, the energy delivered to the repeater circuit would be only one sixty-fourth of the original energy. Of this only one-half reaches the receiving element for the rest is dissipated in the bridge. Hence there must be supplied to the line on the output side of the repeater circuit 128 times as much energy as is received. A glance at the circuit of Fig. 5 shows, however, that the output of the repeater itself is equally supplied to the outgoing and the incoming lines. The element must be capable, therefore, of supplying 256 times as much energy as it receives. In other words, the element should have a telephone efficiency of about twenty-six thousand per cent.

4. The sources of energy associated with the element, and by virtue of which amplification is possible, must have voltages which may safely and conveniently be utilized in the telephone plant. For example, a repeater whose source of energy had a voltage of greater than 250 would be unsatisfactory in a plant which normally employs voltages not greatly exceeding 100.

5. The element must be either insensitive to external electrical disturbances or easily shielded from them so that crosstalk from neighboring telephone circuits or apparatus may not actuate it.

5a. Conversely, the element must not be such as to crosstalk into adjacent circuits or apparatus.

6. The element must be constant in behavior, reliable and of fair life, and not such as to require frequent attention or laboratory conditions of operation. In other words the element must meet the conditions as to reliability of service which apply to other portions of the telephone plant.

7. In size, first cost, cost of energy and of maintenance, the element must conform to the economic conditions of an established plant.

Recognition of these conditions has guided our search for new elements during the past fruitful decade. Even before that time these requirements were recognized although they were not completely formulated. It is surprising how many independent inventors approached us during this time with devices formed by coils and magnets but involving no source of energy, or at least utilizing none, and hence patiently incapable of producing amplification. Inherently such devices were static transformers, on the low voltage side of which there might be a greater current but obviously not a greater power than there was expended as input on the high voltage side. In some instances such devices were said to be intended for frequent use along a telephone line at fairly regular intervals. Such effect in improving telephone transmission as they might have would then be explainable by their function as inductances in the line; in other words, by the loading of the line. They thus offered imperfect substitutes for Dr. Pupin's method of loading.

Most of the earlier attempts at the design of telephone repeaters followed the recognized lines of telegraph practice or of electrical power engineering. The life of the telephone, however, has been almost contemporaneous with that of the newer physics which deals with discharges through rarefied gases and which has led to the discovery of the electron and of steady electron streams in vacua. General knowledge of the electronic structure of matter has grown by leaps and bounds in the last few years and coincident with this growth has been our practical development of electronic repeaters.

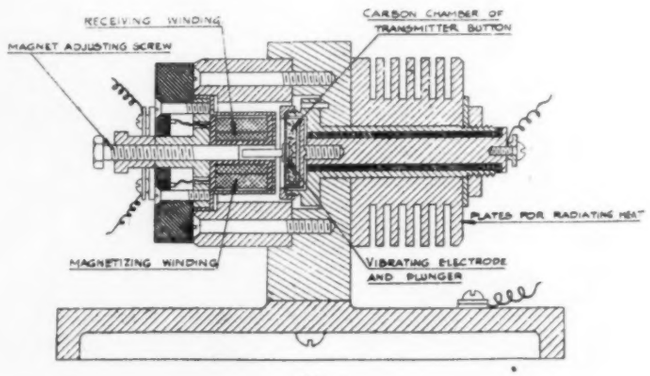
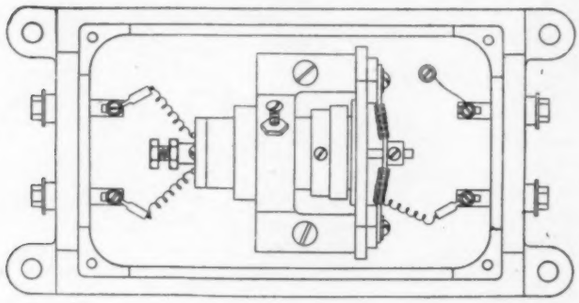


Fig. 7.

For purposes of classification, therefore, we may divide repeating elements into three groups depending upon whether their moving parts consist of (a) molecular irons, (b) elec-

trons, or (c) molecular aggregates, that is, ponderable matter in the ordinary sense. The first group we might call "gaseous," the second "electronic," and the third, "electodynamic." We may also classify according to the means by which the moving parts are actuated, as (a) electromagnetic if the operation is dependent upon a magnetic field which is altered by the received current, and (b) electrostatic if operation is dependent upon an electrical field which is established or altered by the received current.

Electrostatic devices involving moving members of mechanical size are too insensitive to serve as telephone repeaters. In the case of gaseous or electronic devices such a method of control is, however, entirely practicable and, indeed, for electronic systems marvelously effective. Our system of classification may, therefore, be simplified by the omission of one class of mechanical devices. It must, on the other hand, be further complicated by the introduction under gaseous repeaters of a type of device which has no cognate in the other two classes. Such devices are conductors which depend upon the passage of current through themselves to alter their own characteristics.



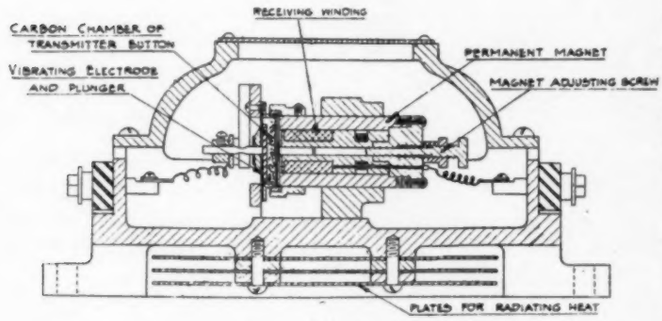


Fig. 8.

Something of this behavior is familiar to all engineers who have worked with carbon arcs and remembered their instability. For our purpose we may designate this type of repeater as a "negative resistance device" and postpone the justification of the terminology to later discussion.

The classification of repeater elements in the order in which they will be discussed is, then, as follows:

I. Electrodynamic repeaters
A. Receiver transmitter type.
B. Generator type.
1. Direct current generator
2. Alternating current generator
3. Asynchronous generator.
II. Electronic Repeaters.
A. Electrostatic
B. Electromagnetic
III. Gaseous Repeaters
A. Electrostatic
B. Electromagnetic
C. Negative Resistance

I-A. The form of telephone repeater which most naturally suggested itself to the early engineers is the combination of a receiver and a microphone essentially in the manner depicted in connection with our earlier discussion of the problem presented to telephone engineers by the necessity of increasing the range of telephonic communication. In the early years of telephony no other means seemed available and prior to 1903 many unsuccessful attempts were made along this line. The parent Bell organization devoted the efforts of a large number of its best men to this problem which was also a favorite with inventors outside of its organization. In the minds of the general scientific world further interest had been stimulated by the reported offer of a capitalist to pay one million dollars for a successful invention.

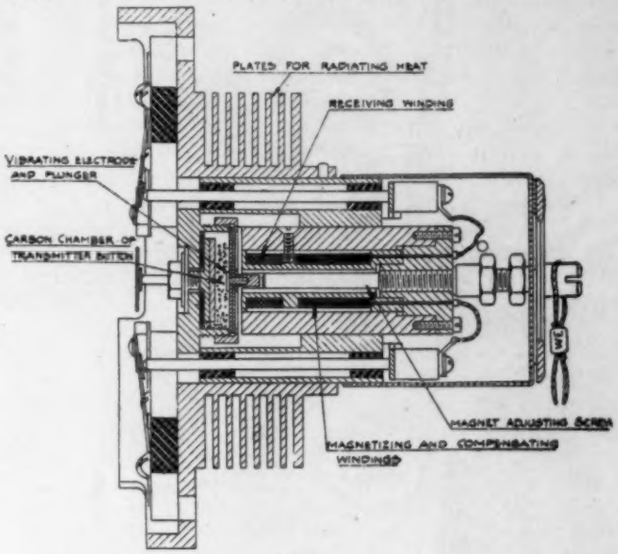


Fig. 9.

The solution was finally reached by one of the Bell engineers, H. E. Shreeve, who was assigned to the problem in 1903 after an earlier experience in the design of microphones and other telephone devices. Previous inventors had combined receivers and transmitters without recognizing that the normal functions of their diaphragms were those of sound collecting or emitting members and Shreeve omitted these unnecessary features.

Another difficulty in earlier designs had been the "packing" of the carbon of the microphone and one of his first studies had to do with its cause and elimination. He found it to be due to expansion which was occasioned by the heat liberated in the carbon chamber. In his first successful laboratory model a stretched steel strip was used as a connecting link between the receiver and the microphone and the microphone was designed so that the expansion of its part under the influence of heat did not subject the granular carbon between the electrodes to increased pressure.

With this form was obtained our first successful test of repeater operation over a telephone line. The device was tried in 1904 on a circuit between Amesbury, Massachusetts, and Boston and resulted in a greater intelligibility in the transmission of long lists of unrelated words than could be obtained over the circuit without the repeater.

The next step was to obtain more

perfect quality reproduction and this was secured by making lighter moving parts and increasing the natural frequency of the moving system. The next model, shown in Fig. 7, was commercially operated on a circuit between New York and Chicago, from August 1904 to February, 1905. In this model the packing of the transmitter element was obviated by the thermostatic action of the vibrating disk, and the natural period of the moving parts was such as to emphasize the important frequencies of the voice. The element was associated with the line by a simple bridge circuit which had been patented by Edison in 1883. The transmission between New York and Chicago was found to be greatly improved.

In this installation an additional feature was incorporated to prevent amplification of the so-called "Morse thump," which occurs when a repeatered line is composited and carries superimposed telegraph signals. A repeating coil of low mutual inductance was inserted between the line and the receiving element. This coil was inefficient for currents of low frequency but was relatively efficient for those of voice frequency.

In spite of the success which was obtained with this first repeater installation, the problem was far from being solved. In fact, when an attempt was made to reproduce the model, it was found extremely difficult to obtain vibrating electrodes, which had the necessary thermostatic action in addition to other necessary characteristics. An attempt was, therefore, made to regulate the sensitiveness of the microphone by more positive means and the next model, Fig. 8, had the feature of a thermostat in the form of a zinc strip. This zinc strip was heated by a coil, which was in series with the microphone, and whenever the current through the microphone increased as the result of incipient packing it served to withdraw the rear electrode.

This repeater, known as No. I-A, was reasonably satisfactory in service until the requirements became more exacting, particularly in the matter of tandem operation with the attendant requirements of improved quality reproduction. An intensive study was therefore undertaken, with the result that the natural frequency of the vibrating system was raised still higher, the weight of the moving parts was still further reduced and a still more sensitive form of regulator adopted.

Without going into too much detail in regard to intermediate steps which were made between the 1-A repeater and the so-called 3-A type, which is the present standard for instruments of this type, it will be sufficient to describe the features of this latest model and to point out the inherent limitations of this class of repeater.

The 3-A repeater, Fig. 9, is of the so-called "cartridge" type and consists of two main parts, the cartridge and the socket. The cartridge contains all of the working parts which are liable to become defective in service and may readily be removed from circuit for the purpose of replacement. It is held in place in the socket by a bayonet catch, and electrical connections are made to its contact posts by springs in the socket. The regulatting means which serve to maintain the sensitiveness of the microphone between extremely narrow limits consists of an electro-magnet with differential windings. The initial magnetic field of the receiving element is the resultant field produced by a winding in series with the microphone and an opposing winding in shunt with the microphone. If the steady resistance of the microphone increases, the series winding takes less current and the shunt winding more, or vice versa. These magnetic changes alter the pull on the flexible disk electrode and thus serve to regulate the pressure on the granular carbon.

An inherent defect in this type of instrument is the fact that the sensitiveness falls off rapidly when the input energy is below a certain minimum. At the present time no completely satisfactory explanation for this phenomenon has been advanced. A defect of this character is obviously serious in the operating plant where circuit conditions and volumes of energy at any given point in a circuit fluctuate widely from time to time. Thus at one moment the repeater in a given circuit may be handling the energy from two persons speaking loudly, using telephones very near the terminals of the circuit, while at the next moment it may be called upon to function with the energy which it receives from telephones connected to long circuits, which in turn connect to the circuit with which it is associated. If the persons using the telephones in this latter case have weak voices, if they do not use the telephones properly by talking directly into the transmitter, or if the apparatus or lines themselves are inefficient, it is clear that the energy at the repeater terminals may be many times less than that in the previous case. Further under those conditions maximum amplification is the more to be desired so that a repeater element whose performance fluctuates with the amount of energy which it receives and particularly one whose performance is worse when operating with the smallest energy is subject to a handicap when it comes to applying it generally in the telephone plant.

The Shreeve type of mechanical repeater is nevertheless distinctly serviceable and many units are in commercial service. The amplication is not, however, sufficiently independent either of the amplitude or of the frequency of the input to make them adaptable with best results to use in tandem, although they have been used to advantage on telephone lines the length of which did not require more than three repeater stations.

(To Be Continued.)

Dallas Abolishes Charges for Installations

An ordinance eliminating the present charges for the installation of telephones in Dallas was passed by the city commission. The ordinance bears the emergency clause and goes into effect immediately the rule having been suspended and the ordinance passed third reading.

The telephone company is making a charge of $3.50 for the installation of telephones in houses where telephones are not already on the wall and $1.50 for making the connections and change of name in the directory for telephones where the instrument is in the house.

The ordinance was passed following an opinion by City Attorney Collins to the effect the charges being imposed were illegal.

The charges for moving telephones from one house to another or from one office to another or from one place inside the house or building to another was left to the discretion of the city commission, it being held by City Attorney Collins that a reasonable charge was legal.

Dormitory accommodations for 150 girls are to be installed by the Michigan State Telephone Company on the third floor of the new exchange building, Cass and Michigan Avenues, Detroit. Fifty rooms, with three beds to a room, are planned, together with cooking and recreational facilities.

Publicity for Public Utilities

Address Before the United States Independent Telephone Association

By B. J. MULLANEY*

WHAT I have to say to telephone men would be equally applicable to men engaged in any other line of the public utility business, whether it be gas, electric light and power, street railway, water or any other. Outside of the individual problems that are peculiar to your own particular business, your own line of business, or your own individual businesses, in the broader aspects of all that you do, you are in the same boat with all the other utility people.

We do not have to talk about government ownership, perhaps, as much now as we did at one time, after recent experiences and the publicity of the results achieved. But all of you gentlemen are still subject to regulation and subject to discussion as to the form that that regulation shall take. All utilities have to live on the rates they get for their service. Practically all of them have to borrow money from time to time for extension of plants and all that sort of thing, so that with respect to regulation of rates and maintenance of their credit and everything that enters into successful development, growth and life of their business, they are dependent in the long run upon the attitude toward them of that great master that we call the public.

The public is the master of your fate as it is in the long run of all public utilities. Hence the necessity that the public, upon whose good will you depend not only for your year round success in business, but for the safety and permanence of your business, shall understand the broad, fundamental, economic principles that govern your business; because without that understanding on the part of the public you are very apt to run against situations more or less frequently that will be intensely damaging.

There is just one way of getting into the good graces of this mass of people that is your master, and that is by means of what we call publicity.

There are many different kinds of publicity, many channels.

When you are gossiping with a neighbor while watering the lawn, when you are talking with him in the smoking room of a sleeping car, talking over the luncheon table, addressing Rotary Clubs, business men's associations, women's clubs—all those are publicity channels. But, when all is said and done, the main channel of all is the newspaper. All of the other facilities for the employment of publicity in spreading facts, information and better understanding of your business or any other utility business are useful and can be employed to supplement the channel provided by newspapers, but they cannot take the place of it.

Practically everybody reads newspapers. That is almost literally true. It is also true that the few who do not read the newspapers will, in ninety-nine per cent of cases, follow the lead of those who do. Even men who boast that they are not influenced by what they see in the papers—take any one of them, study him for a day or part of a day, and you will find that at every turn of his conversation his opinions reflect what he has been reading in the papers; perhaps without his realizing it, but he reflects it just the same.

How are we going to make effective use of this newspaper channel of publicity? If I could give you the answer to that offhand or even put it into a book of a thousand pages or into a set of books, and guarantee that my answer was correct, I could collect fees for my advice that would make Rockefeller jealous. I cannot undertake to do that. I do not believe anybody else can. But there are some do's and don'ts in connection with the problem that we can get into our minds and ten wait for results. We shall have to do some waiting for results. Getting results out of this thing we call publicity is a good deal like waiting for a crop. No matter how careful, how skillful your tillage may be, the wind and the rain and the sun are still factors, and they tell what the harvest will be in the long run.

Under the head of "don't," one requisite of any kind of publicity effort in behalf of public utilities or any other worth while enterpise is that it shall, in the language of the street, "come clean." It has got to be frank, open and above board. It has got to be honest. The day of getting what we used to call "sneak publicity" has gone by. The telephone company or the telephone interests or any other public utility interests that have not got a case good enough to stand on its own merits had better keep away from publicity.

The kind of matter—perhaps that comes next. No matter how well conceived, how skillfully and intelligently executed the preparation of so-called publicity matter may be, it is not much good unless it gets printed. The stuff that goes into the waste basket is simply wasted time and effort and good paper and ink spoiled. For that reason, to boil it down to the lowest residuum as a general proposition, publicity matter in behalf of the Independent telephone interests or any other utility that is intended for general circulation for application to the mass of the people, that would suit you right down to the ground, meet your ideas exactly as to what ought to be printed—that kind of matter is probably the very poorest kind to try to put out. In the first place, it would be so obviously one sided, it probably would never get printed anywhere in any kind of a publication of general circulation that was not serving the special interests; and if it got printed or if you got it printed by hook or by crook, its very onesidedness would defeat its purpose and the reader would not be influenced by it.

The most effective kind of publicity in the world is that which is unobtrusive; is that which depends upon building public opinion little by little; as our opinions about public affairs are built up slowly but permanently from the news of the day until we have a sound bedrock impression that winds and waves and little shocks do not disturb.

Now the place to start getting effective publicity in these broader aspects for the Independent telephone industry or any other, is in your home town papers, and the way to start is to use the advertising columns of your home town papers as much as you can. That is for two reasons.

First. Your telephone company may be the only one in the town. You know that the service is good and the rates are fair; everybody that wants a telephone has got to come to you; and you say, naturally, "Why should

*Director of the Illinois Committee on Public Utility Information.

I advertise?" Perhaps it is not an absolute essential that you should advertise to continue in business, but this is literally the fact: The experience of the advertising world generally is that even under those conditions it pays to advertise your service to your customers. It will pay in dollars reflected in the cash drawer and on the balance sheet. It will pay in good will, and that is plus. It will pay in good will that will come to your rescue sometime when you have a real problem on which your customers, perhaps, as a part of the general public, will have the deciding voice.

Mr. Kin Hubbard, of Indianapolis, tells us in Abe Martin's philosophy, that the prettiest girl in town is likely to die an old maid if she doesn't get out and advertise a little.

You may think your telephone service is the best possible, at the lowest possible price; but your customers will not know that unless you tell them about it. We are accustomed to take for granted or to regard as only a commonplace the thing that is close at hand. That is where we get the proverb that "a prophet is not without honor save in his own country." The folks are accustomed to see him around in shirt sleeves and that view obscures the prophet and they do not recognize him until his fame comes back from abroad or he gets a good press agent.

So I repeat to you, the use of the columns of your home town paper, even if you do not think you need it, is a good investment, which, if you will give it a good trial, will bring back dollars. Your local editor is undoubtedly a customer of yours; he has to be. Why shouldn't you, just for reciprocity, be a customer of his? When you do that you have made a friend. Not that you are going to buy his news columns by spending money in his advertising columns. If his paper is any good you can not; but you do get the right to go into his office and talk to him about any point that arises in connection with your business. You can talk across the desk until you are out of breath, without getting very far; but if you can lean on my shoulder and say, "Here, old man, that was hardly a fair deal in this morning's paper," then you get inside my guard, and if your case is good you win; there is no question about it.

There is another thing to do, in the matter of cultivating relations with your home paper. Make some news for that paper. That is what it lives on. It is a tradition among outsiders, although a false one, that the newspaper lives on the advertising in its columns. In a very narrow, literal sense that is true; but unless it has news to sell to its readers to get circulation, it will have no advertising to sell, or at least it will not get much money for the advertising.

But news is the thing the editor lives on. Help make a little news for him. When you are undertaking something, when you are planning something, going into some new enterprise, extending your plant or service, tell him about it; find occasions to tell him about it. If some question comes up where perhaps you are under fire to some extent, do not run and hide. Talk right out to the public through the news columns of the home paper. The editor will let you do it if you go to him frankly. You may in the course of it have some unpleasant things said about you, but come back straight with your side. You may not seem to be getting far in the beginning, but if you will keep at it the unpleasant things will grow less and less and less until they disappear and you will be on a sound foundation.

In connection with that—probably this is unnecessary, but usually in a gathering of this kind there are more or less who need to have this suggestion made—help out your general program, as I have only sketched it very briefly, just touching the high spots in relation to getting helpful publicity, by becoming an active part of your home town community. If there is a commercial association or business men's association or any other representative gathering, you ought to be in it and of it, and once you are in it and of it, you ought to be co-operative with respect to the broad questions, with every other utility man in that town.

Get together and do a little team work. Talk over your common problems where they touch each other. In your dealings with the people and with the newspapers, all the way along the line, just pull together a little bit. There will be times when the Rotary Club or the woman's club or some other association will be very glad to have a speaker on the program that will discuss your problems from your point of view as it concerns the general public. When you get that done you are doing two things. You are reaching men who perhaps do not read the newspapers much and your message is being spread throughout the community.

This which I have had to say does not pretend to be a complete program. As I suggested in the beginning, it is merely a hint as to a few don'ts and a few does. The does are especially important. If men in the Independent telephone industry or any other part of the public utility industry would just make a point of putting their minds to it and not depending upon all of the work of a publicity nature to be done by somebody that is working for you in a Chicago office or a St. Louis office or a New York office—trying to build up public opinion in your behalf at long range through the mails and over the telephone and telegraph wires—you will get farther. Just make it a part of your job, each of you in your home towns, to cultivate your local newspaper, to get your local newspaper interested in your business and in some of the problems of it. Then almost before you know it you will have the entire field, the entire country, cultivated and you will have the foundation laid for a sound public opinion that will make your business just as safe as a bank, and that will take these public utility questions out of controversy and will leave you as immune from attack by the politician and the agitator as the public schools are.

Makes Telephone Secret by Distortion

A French army officer claims to have invented a device which will prevent listening in on telephone conversations. It consists of attachments which may be fitted to the instruments in use whenever the conversation is of such a confidential nature that the parties wish to be sure no one overhears it. The effect of these devices is to distort the sound. Anyone listening in on the line would hear voices, but they would be unintelligible. The telephone currents, as they are produced at the transmitting end, are deformed by the attachment, and reformed by the one at the receiving end. The apparatus, it is said, is very delicate and complicated. It was developed for use at the front during the war, and experiments were being made with it when the armistice was signed. For the present, it is said, it is likely the benefits of the invention will be preserved for official usage and withheld from the general market. Such apparatus, whose scheme appears entirely feasible, might be of especial value for wireless telephone work.

Report of the Postmaster General

On the Supervision and Operation of the Telegraph, Telephone and Cable Properties, October 31, 1919.

TO THE PRESIDENT:

By act of Congress approved July 11, 1919, provision was made for the return of the telegraph, telephone, and cable properties to their respective owners at midnight of July 31, 1919. The telegraph and telephone properties were returned at midnight of July 31, 1919, by a formal order of the Postmaster General dated July 30, 1919; the cable properties having been returned at midnight of May 2, 1919. The telegraph and telephone properties were taken over for Federal control on August 1, 1918, and the marine cable properties on November 2, 1918.

In the above-named act is is further provided that—

> Within 90 days after this act shall take effect the President shall cause to be made to the Congress a detailed account and report of all his acts and proceedings in connection with the supervision, possession, control, and operation of the telephone, telegraph, and marine cable systems of the United States, and of all moneys received and expended, and all property and assets acquired or held, and all liabilities or obligations incurred, including contract relative to compensation awards, such report to show in detail the financial results of the operation of each separate wire system from August 1, 1918, up to the date when the said systems shall have been returned.

It is the purpose of the present report to meet the above-named requirements so far as that is possible before final settlements have been negotiated with the respective companies concerned.

The purpose of this report is twofold. It undertakes in the first place to explain to Congress the manner in which the Postmaster General, acting for the President, has administered the properties placed in his control; and in the second place to furnish Congress with an estimate of the deficit incurred during the year of Federal operation and to explain the reasons for such deficit. It is not possible to submit final figures for each separate wire system relative to the operating revenues, operating expenses, and income charges until final adjustments have been made with the respective companies. The figures submitted, however, including estimates, may be relied upon for the determination of whatever policy Congress may think it wise to adopt for final settlements with the owners of these properties.

A. S. Burleson,
Postmaster General.

PROPERTIES TAKEN OVER.

The first step, for a proper understanding of the management by the Government of the properties under consideration, is to learn the kind and the amount of the properties taken over.

By a proclamation of the President dated July 22, 1918, the Government took possession and assumed control and supervision "of each and every telegraph and telephone system, and every part thereof, within the jurisdiction of the United States, including all equipment thereof and appurtenances thereto whatsoever and all materials and supplies." This proclamation covered all properties engaged in the transmission of intelligence by electric energy with the exception of marine cable and radio systems.

By another proclamation dated November 2, 1918, the possession, control, and supervision of the Government was extended to "every marine cable system and every part thereof owned or controlled and operated by any company or companies organized and existing under the laws of the United States, or any State thereof, including all equipment therof and appurtenances thereto whatsoever and all material and supplies."

It thus appears that the only instrumentality for the transmission of intelligence making use of the agency of electricity, covered by the act of July 16, 1918, not thus taken over and placed under the control of the Postmaster General, was that of the radio systems, which had theretofore been placed under the control of the Navy Department.

The language of the act, however, does not adequately describe the properties taken over by the Government when regarded from the point of view of administration; nor is the classification of these properties, as telephone properties, telegraph properties, and cable properties, adequate for this report. Telephone properties must be further classified in order to indicate their character and the nature of the service which they render. This report avails itself of the classification framed by the Interstate Commerce commission in its supervisory administration of this class of properties, and used by the Census Office in its statistical investigations and compilations. It treats telephone companies under the following heads:

Class A.—Telephone companies which have a gross operating revenue of $250,000.

Class B.—Telephone companies which have an operating revenue from $50,000 to $249,999, inclusive.

Class C.—Telephone companies which have an operating revenue from $10,000 to $49,999, inclusive.

Class D.—Telephone companies which have an operating revenue of less than $10,000.

To these are added mutual or noncommercial companies.

By far the larger number of telephone companies are mutual noncommercial companies. These are com-

monly called farmers' telephone lines, although there are a few mutual companies that do not serve rural communities. In his statement of July 23, 1918, the Postmaster General said that "the operation or control of what are commonly called farmers' telephone lines will be interfered with only for the purpose of facilitating their connections with the longer lines." The fact that these "mutual" lines lie outside the purpose of the Government in taking over this class of properties was further recognized by an order of the Postmaster General dated November 18, 1918, which formally released these lines from supervision and control. This order reads as follows:

Until otherwise ordered by the Postmaster General, any firm, company, or association, whether incorporated or unincorporated, owning or operating telephone systems, system, or par of system as a co-operative enterprise and receiving no revenue either directly or indirectly from any source other than from its own partners, stockholders, or members as assessments or dues, shall not be required to comply with the orders of the Postmaster General affecting telephone companies; and, until otherwise ordered by the Postmaster General, any such system or part of system so owned or operated and now connected with any system under Government control shall continue to be so connected on the terms and conditions now governing such connections, if such systems, system, or part of system shall be maintained and operated at a standard satisfactory to the Postmaster General, and no extension shall be made until after the plans for such extension shall be approved by the Postmaster General.

The number and grade of the telephone companies, other than the mutual companies released by the above quoted order, are as follows:

Class A companies	61
Class B companies	165
Class C companies	755
Class D companies (about)	8,000

An investigation of the general situation made it evident that commercial companies whose gross revenues did not exceed $10,000 were of slight importance in view of the purpose for which these properties were taken over, and under an order of the Postmaster General issued April 9, 1919, class D companies were "authorized to operate and manage their properties free from direct Federal supervision under license" upon certain conditions named. Failure to notify was construed as an acceptance of the authorization, and only 171 companies out of the total of about 8,000 expressed their preference to remain under direct Federal supervision and control.

The noncommercial mutual companies having been eliminated and most of class D companies having been given the status of licensees, the number of telephone companies of all classes, for which the Government assumes some degree of operating responsibility, is 1,152. It is with these telephone companies that the remainder of this report is concerned.

An impression of the magnitude and the character of the telephone industry in 1917 may be gained from certain statistics furnished by the Census Office:

Miles of wire	28,827,091
Number of telephones	11,713,228
Estimated number of messages or talks	21,842,425,620
Number of public exchanges	21,174
Number of employes	262,622
Salaries and wages paid	$ 175,668,299
Income from all sources	391,476,926
Expenses and fixed charges	319,116,293
Value of plant and equipment	1,492,230,081

Of telegraph companies there were 14 which came under the joint resolution of July 16, 1918. These are:

The Western Union Telegraph Co., of New York.
The Postal Telegraph-Cable System, of New York.
The Canadian Pacific Railway Co., of Montreal (operating a commercial telegraph system).
The Central Idaho Telegraph & Telephone Co., of Weiser, Idaho.
The Colorado & Wyoming Telegraph Co., of Denver.
The Continental Telegraph Co., of Chicago.
The Federal Telegraph Co., of San Francisco.
The Marthas Vineyard Telegraph Co., of Woods Hole, Mass.
The Mountain Telegraph Co., of Denver.
The North American Telegraph Co., of Minneapolis.
The Northern Telegraph Co., of Bangor, Me.
The Philadelphia, Reading & Pottsville Telegraph Co., of Philadelphia.
The Postal Telegraph-Cable Co., of Dallas, Texas.
The Vermont International Telegraph Co., of St. Johnsbury, Vt.

All of these companies, with the possible exception of The Canadian Pacific Railway Company, of Montreal, were recognized as a part of the national system of telegraphs and telephones for the operation of which, during the year of Federal control, the Postmaster General is responsible.

On November 2, 1918, when the "marine cable systems" were taken over by proclamation of the President, the following companies were operating in the United States:

Western Union Telegraph Co.
Commercial Cable Co.
Commercial Pacific Cable Co.
Mexican Telegraph Co.
Commercial Cable Co. of Cuba.
Central & South American Telegraph Co.
United States & Hayti Telegraph & Cable Co.
French Telegraph-Cable Co.
German Atlantic Telegraph Co.

The proclamation of the President was confined to companies "organized and existing under the laws of the United States." The French and German cable companies were thus eliminated, but the other seven companies are regarded as part of the national system of wire control.

On April 29, 1919, an order was issued to take effect at midnight on May 2, 1919, which returned the marine cable systems to their respective owners. The occupancy and operation of these properties covered a period of six months.

ADMINISTRATIVE THEORY ADOPTED.

An administrative interpretation of any law which confers authority is necessary before an executive officer can undertake the task of administration. On this point it should be noted, in the first place, that the President, in his proclamation of July 22, 1918, provided that "The supervision, possession, control, and operation of said telegraph and telephone systems hereby by me undertaken shall be exercised by the Postmaster General, Albert S. Burleson." This is the authority for whatever the Postmaster General has done in connection with these properties. The Postmaster General thus became the responsible head of the United States Telegraph and Telephone Administration during the period that these properties were in the possession and under the control of the Federal Government.

The proclamation of the President further provided, in effect, that the Postmaster General might avail himself of the services of those who were in the management and operation of these properties on August 1, 1918. This was done. On August 1, 1918, the Postmaster General issued an order, in which it is stated that "Until further notice, the telegraph and telephone companies shall continue operation in the ordinary course of business through regular channels." Such an adjustment means that the corporations, or the operating organizations of the respective companies whose property the Government had taken over, were accepted as agents of the Government to act under the direction of the Postmaster General and in the interests of the Government. It means also that the Government, on its part, assumed such responsibilities and obligations as normally accrue under the ordinary operation of the properties. It is highly important as

bearing upon the character and results of this year of Federal supervision and control of the telegraph and telephone properties, to note that, with a single exception, the owners of these properties have not been separated from their operation.

The organization of the personal staff of the Postmaster General for the supervision of the operation of these properties comprised three divisions or departments, besides quite a number of special committees appointed for investigation and recommendation on specific points. These divisions are:

A committee commonly known as the Wire Control Board. This committee is composed of three members and the Postmaster General as chairman; one member, John C. Koons, First Assistant Postmaster General, having charge of the "administration and organization of the service"; one member, David J. Lewis, United States tariff commissioner, having charge of "operation"; and one member, William H. Lamar, solicitor for the Post Office Department, having charge of "law and finances." This committee was appointed by an order dated July 23, 1918.

On December 13, 1918, an "Operating Board" was created, to take in charge the "operation of the telephone and telegraph service under Government operation and control." The members of this board were experienced operating officials of the telegraph and telephone companies. They assumed responsibility for the operation of the property on January 1, 1919, and continued their duties until June 14, 1919.

There was also organized under the Wire Control Board a small Accounting Division. It was the function of this division to make investigations when necessary for testing the information submitted by individual companies in their claims for compensation, and since the enactment of the law of July 11, 1919, which provides for the return of the properties to their respective owners, this division has been chiefly engaged in making provision for final settlements on return of the properties.

In this connection it may be said that the expenditure incurred by the Postmaster General for the direct supervision and administration of these properties, up to October 31, 1919, amounted to $77,150. With the exception of $12,000 furnished from the "general defense fund," this expense is a charge against the operations of the properties. It was understood when these properties were taken over, that they should be operated within their revenues. Persistent effort was made to keep the administration expense at the lowest possible figure in order to avoid any obligation on the part of the Government to provide for a deficiency.

THE ADMINISTRATIVE POLICY FOLLOWED.

Political and international events moved so rapidly during the period covered by Federal control of the telegraph and telephone properties that it is scarcely possible to speak of a consistent policy of administration and management. When these properties were taken over on August 1, 1918, it was generally assumed that they would be in the possession of the Government for at least three years, one additional year of war, one year before the proclamation of peace, and one year allowed for adjustment and settlement should Congress at the close of the war require the return of the properties. This was a reasonable expectation and is responsible for some of the projects set on foot under the direction of the Postmaster General.

It was, for example, responsible for undertaking the co-ordination and unification of all service rendered by these properties "so that they may be operated as a national system with due regard to the interests of the public and the owners of the properties." This purpose was expressed by the Postmaster General when, on August 1, 1918, he made public declaration of the fact that these properties had been placed under his control. He understood that these properties were taken over as a war measure, but that this purpose contemplated not merely greater facility, certainty, and safety in the transmission of military and Government communications, but aid in the mobilization of all man power, and in the economy of all material resources required by the Government for the prosecution of the war. It was his understanding that the joint resolution, approved July 16, 1918, was an integral part of the legislative policy of Congress for the conduct of the war.

Proceeding from such a premise, questions of possible economy in the management of the property, of consolidations for the purpose of getting rid of pernicious competition and wasteful operation, and of a general standardization of rates and rules of operation, forced themselves upon the consideration of those in charge of the properties. A cursory discussion of the three classes of questions thus raised will make clear the point of view from which the Wire Con-

There are still about 600 out-of-town operators in Washington and more than 400 of them live at Monroe Courts, pictured above. This big building is fitted up in the best of style and everything is done by the management to make life pleasant for the girls.—"The Transmitter."

trol Board regarded the task which it had assumed.

Under date of August 1, 1918, a letter was received from Mr. Edward Reynolds, vice president and general manager of the Postal Telegraph-Cable Co., of New York, N. Y., which contained many suggestions for unification, standardization, and economies. The Postmaster General was greatly impressed with these suggestions, and, had the period of control been sufficiently extended, would have undertaken to realize some of them at least in practice. One observation is of especial interest—under the heading "Organization," Mr. Reynolds says:

> I would suggest that a list of all officials (and in this list I would include general managers, vice-presidents, commercial agents of every description, district superintendents and solicitors) be prepared, and after having this list in hand decide how many on the list are unnecessary under Government control, and detail these to essential duties.

This letter expresses, in the language of an efficient operating official of a telegraph company, what is meant from the operating point of view by a national system of telegraphs and telephones. As a matter of fact, these properties were not under the control of the Government long enough to warrant the consideration of any extended plan of reorganization whether of the operating departments or the personnel of the properties taken over. With the exception of a single company, the original order of the Postmaster General according to which the companies were instructed to "continue operation in the ordinary course of business through regular channels" remained in force throughout the year of Federal control. This proved to be most fortunate, in view of the subsequent act of Congress providing for the return of these properties to their owners on August 1, 1919. It made it possible to return these properties without embarrassment either to the companies or to the Government. Nothing during the year of Federal control was done which changed the relation of the operating officials of the respective corporations to the properties under their management.

Much, however, was in contemplation designed to secure greater efficiency and economy in the use of employes and facilities during the first few months of Federal administration. Interchange in the use of wires, the elimination of duplicate offices, the use of postal agencies in the small towns for both telegraph and telephone service, are illustrations of the problems taken up for consideration. But the uncertainty of tenure, after the signing of the armistice, made the discussion of this class of problems, for the time, academic rather than practical. There is, however, no question of the potential economies under a national system of telegraphs and telephones, provided such a system were brought under an efficient and intelligent management.

This national point of view is further illustrated by the steps taken for the consolidation of competing properties. In no instance did the Postmaster General force such consolidation. He did, however, appoint a committee for the investigation of this question, and expressed in a bulletin of August 7, 1918, that the officials in charge of the Government operation and control of the telephone systems had no objections to such consolidations. Thirty-four consolidations have been approved by the Postmaster General during the period of Government control.

Nothing, however, has been done under this heading to interfere in any way with the return of the properties to their rightful owners.

Another important step in the development of a national system of telegraphs and telephones is the standardization of charges for services rendered. Such standardization is a matter of more than local interest. On September 10, 1918, a committee was appointed for the study of telephone rates, known as the Committee on Standardization and Unification of Rates. This committee was composed of one member of the Wire Control Board, a vice president of the American Telegraph & Telephone Company, a president of one of the important Independent telephone lines, and two members of State public-utilities commissions. A similar committee was appointed for the study of telegraph rates. These committees had many sittings, and began investigations which, had they been carried through as contemplated, might have provided for this country a systematic and scientific adjustment of telegraph and telephone rates. The only important recommendation resulting from these studies, which went so far as to become an order of the Postmaster General, is found in Order No. 2495, issued on December 13, 1918. This order classified the toll telephone service and provided uniform charges for this service. The order is of sufficient importance to claim an independent consideration. It is mentioned in this connection as indicating the general point of view from which the work of the Wire Control Board was undertaken, and as one feature in a policy which necessarily came to a close when it became evident that the period of Government control might be shorter than had been anticipated.

SERVICE-CONNECTION CHARGE.

The service-connection charge as originally imposed by the order of August 28, 1918, is no part of the program of standardization referred to above. It was a war measure, and its merits or demerits should be judged from that point of view. The general facts are as follows:

In July and August, 1918, the War Department was making very heavy demands on the telephone industry for material, such as instruments, lines, wire, and general equipment, and for men, particularly linemen and skilled electricians. The Signal Corps needed larger quantities of material and more trained men than it was easy to secure. This being the case, it was essential that the telephone companies should curtail their normal expenditure for extensions and temporarily arrest the normal development of their business.

This result might have been secured through the agency of the Capital Issues Committee in so far as telephone extensions were to be financed through the issue of new securities; but this method of procedure would not have secured quick results. Appeal might have been made to the War Industries Board for its assistance in diverting the energy and the capital of the telephone companies from the extension of their own lines to the war service of the Government. But in view of the large number of companies involved in the manufacture of telephone apparatus, and of the complex character of the output, it would have been very difficult for the War Industries Board to bring about the result desired. Moreover, neither of these agencies could have touched the real difficulty. It was equally necessary that the curtailment of telephone investments and the extension of service to new subscribers should be discriminatory in character. Such being the situation, the Postmaster General dealt with the subject directly by establishing service-connection charges which would prevent demands for new connections unless such demands were urgent.

That the prime purpose of the or-

der of August 28, 1918, was military in character, to be justified as a war measure and not as the expression of a commercial purpose, is clear from the fact that the installation charges imposed must be regarded as unreasonably high if judged by commercial standards. These installation charges were as follows:

Where the rate is $2 a month or less.... $5
Where the rate is more than $2, but not exceeding $4 a month..... 10
Where the rate is more than $4 a month 15

Such rates as these, which have no reference to the cost of installation, fall under the head of what is known to the trade as "Penalty" price. The result of their application was to deter subscribers from demanding the installation of new telephones, thus transferring to the War Department the material and labor that might otherwise have been used by the telephone companies.

This interpretation is further supported by the fact that the order itself recites "the necessity for conserving labor and material" as the prime reason for imposing these installation charges. Finally, in further support of this interpretation, the fact may be cited that on November 18, 1918, immediately upon the receipt of trustworthy news as to the armistice, the Postmaster General issued an order which reduced the service-installation charges for the greater part of the telephone business to $3.50. This new order substituted the commercial feature for a "penalty" feature in the installation charges. "Owing to the cessation of hostilities the necessity for conserving labor and material has been relieved to some extent, thereby enabling the Postmaster General to modify" his original order relative to installation charges. Such is the explanation contained in the order of November 18 reducing these charges from $5, $10, and $15, to $1.50 and $3.50.

The first order must be regarded as a war measure; the second order rests on commercial considerations and is designed to relieve permanent subscribers to the telephone service from any portion of the expense incident to the acceptance of new subscribers, or to the wasteful practice of frequent changes due to caprice or to frequent change of residence. The service-connection charges as they now stand must be regarded as one item in the unified and standardized system of telephone charges. The rates themselves might have been changed as the result of experience had the telephone properties remained longer in the hands of the Government; but the principle upon which these rates rest is a sound commercial principle, the application of which, in any particular case, must be tested by the relation which the special rates in question bear to a general scheme of national rates.

TOLL-SERVICE CHARGES.

The telephone service involves two quite distinct classes of service; the one provides facilities for local calls and the other for long-distance calls. Payment for the former is covered by a monthly rental of the instrument either for limited or unlimited service; payment for the latter is computed at the time the service is rendered and bears some relation to the distance covered by the call. This second class of service is involved in the discussion of toll-service charges. It was this service to which the order of December 13, 1918, was addressed.

An examination of the toll-service charges authorized by the Postmaster General will disclose the following significant facts:

The order recognizes distance, the element of time being uniform, as the basis of the rates prescribed. Thus, the initial period rates which were made standard throughout the United States involved a distance between exchanges or toll points not exceeding 40 miles by direct airline measure. For distances in excess of 40 miles, 5 cents additional was charged for each 8 miles. This rule is in harmony with the general proposition that a transportation charge involves two kinds of costs, a terminal cost and a transmission cost, and that the rate per mile for a short distance properly exceeds the rate per mile for a long distance, provided the rate covers both kinds of cost.

The order of December 13, 1918, which provided for the standardization of toll-service charges, elicited considerable criticism in certain lo-

In every public building in Washington will be found plenty of telephone facilities for transients. For instance, in the building occupied by the War Risk Insurance Bureau are two groups of public telephone booths. One group is pictured above. The girl with the big hat is one of the clerks in the building.
—"The Transmitter."

calities where special facilites had been developed for short-time long-distance calls. In some cases the result of the order was to increase rather than to decrease toll rates. In partial recognition of such criticism there was issued on February 17, 1919, a supplemental order designed "to meet public demand for particular-person, messenger, and appointment calls on short haul toll messages." This order also provided for exceptions to the rule that the distance made the basis of the charge should be the air-line distance. Whether or not this supplemental order is an adequate response to the need of the public, it indicates the comprehensive purpose which underlies the Government administration of the telegraph and telephone properties during the period of Federal control. The needs of localities have always been recognized in so far as this was possible without destroying the national character of the service.

A second feature of the order of the Postmaster General which standardized toll-service charges is found in the fact that this order makes general the distinction between station-to-station messages and person-to-person messages. It also recognizes that the individual who requires the telephone service to make an appointment for him with a particular individual at a particular time in another city should pay for that service, and in case a special messenger is required to effect such appointment that he should pay for such messenger. The purpose of the classification of service and rules for charges found in the Postmaster General's order of December 13, 1918, is to secure from each individual a payment in proportion to services received. Whether regarded as a part of a standardized national policy or as an expression of a universally recognized business principle, the purpose which underlies the toll-service charges as promulgated by the Postmaster General is manifest.

A third feature of the order covering toll-service charges pertains to the reduction of the rates for night service. It is provided that between the hours of 8:30 p. m. and 12 midnight, the night rates for station-to-station messages shall be approximately 50 per cent less than the regular day rates, and that the rates from 12 midnight to 4:30 a. m. shall be approximately 75 per cent less than the established day rates. This is an application to the telephone service of the business principle which has made the night letter so successful in the telegraph service. The principle is simple and of universal recognition. It recognizes the fact that the facilities of any industry must provide for carrying the maximum business load, and that if this load can be distributed over the 24 hours of each day, a larger amount of business can be carried on with relatively less investment than if the business done is crowded into relatively few hours of each day. The experiment of night service at reduced rates had never been tried on a national scale. Its trial could in no way embarrass the regular service, and for that reason it was thought worth while to try the experiment. This, too, illustrates the point of view from which the supervision and control by the Government of telephone properties was undertaken.

Quite a number of investigations were set on foot by the Committee on Standardization of Telegraph and Telephone Charges, but with the exception of toll-service charges none of these were carried sufficiently far to warrant the issue of an order, before it became evident that the period of Government supervision and control was likely to be terminated at an early day.

CHANGES IN SCHEDULES OF WAGES AND RATES FOR SERVICE.

During the period the Government was in possession, control, and operation of the telephone, telegraph, and marine cable properties the conditions under which the properties were operated were abnormal. The rise in the costs of labor in all lines of business was marked, and the costs of materials greatly advanced. The rates for telegraph and telephone service which had pevailed before the Government took control of the properties were found to be insufficient to meet these and other increased costs of operation and produce a sufficient amount to be available for just compensation for the use of the properties.

The policy of the Government at the time the properties were taken over was to operate them and pay the compensation for their use from their revenues, and consequently it became necessary to raise the rates for service to accomplish that purpose. The various companies operating the properties as agents for the Government were called upon to prepare new schedules of rates which would produce adequate revenues for this purpose, and an effort was made by the Postmaster General to place these rates into effect, confident that ample power existed in the Government to fix the rates during the period of Government control. However, this position was strongly antagonized by the utilities commissions of various States which contended that their power over rates had not been taken away by the joint resolution under which the Government assumed control of the properties. Injunction suits were promptly filed in many States to restrain the execution of the orders of the Postmaster General increasing the telephone and telegraph rates. These suits resulted in conflicting decisions of the lower courts, and test cases had to be carried to the Supreme Court of the United States before the power of the Postmaster General to fix rates was finally judicially settled. The time thus consumed so greatly delayed the placing into effect of the new rate schedules that sufficient revenue was not collected prior to August 1, 1919, to operate the properties and pay the compensation for their use, and a deficiency will have to be provided for to meet this situation. The exact amount of this deficiency can not be stated until a complete audit of the accounts now in progress has been made. The necessity for this deficiency does not arise from lack of foresight on the part of the wire control board, but is directly chargeable to the institution of these many suits and the early return of the properties to their owners.

In connection with the consideration of this deficit, it seems proper to state that the Government has incurred no obligation for deferred maintenance. The properties have been turned back in as good physical condition as they were when they were taken over. Current charges against current revenues have been ample to maintain the property whether such charges stand for the expenditure of cash to meet current repairs or for the creation of reserves to meet future replacements. In a report, July 15, 1919, to the shareholders of one of the companies representing nearly 80 per cent of the entire telephone service is found the following from its president, the greatest living wire expert.

It is gratifying now to say that your property has been maintained and will be returned in as good-first-class condition as though it had never been out of your possession.

As for the remainder of the telephone service of the country, the following is taken from a resolution of the national convention of the United States Independent Telephone Association, who thus speak for themselves.

Be it resolved, by the United States Independent Telephone Association, representing more than 10,000 Independent telephone systems with representatives present from all sections of the United States, in convention assembled, at Chicago, June 26, 1919, that it hereby expresses to A. S. Burleson, Postmaster General of the United States, and his assistants, its appreciation for his fair, just, and impartial administration of the wire systems of the country.

What has been said of the telephone companies is equally true of the telegraph and cable companies.

Thus it will be seen that the chief reason why the operations of the Government show a deficit rather than a surplus is found in the delay which occurred in making rate increases effective. Had these properties remained longer in the hands of the Government, the financial results would have been quite different from those shown in the last section of this report.

COMPENSATION CONTRACTS.

In the joint resolution approved July 16, 1918, on the authority of which the properties of telegraph, telephone, and marine cable companies were taken over by the Government, it is provided that "just compensation" shall be made for the use of the properties taken over. The text of the resolution touching this point is to the effect "that just compensation shall be made for such supervision, possession, control, and operation to be determined by the President; and if the amount thereof so determined by the President is unsatisfactory to the person to receive the same, such person shall be paid 75 per centum of the amount so determined by the President and shall be entitled to sue the United States to recover such further sum as, added to said 75 per centum, will make up such amount as shall be just compensation therefor."

The determination of just compensation for the use of these properties is at once the most important and the most difficult of the tasks assigned under the resolution. By order of the President, this task has been assumed by the Postmaster General and those whom he associated with him in the administration and operation of these properties. It is the purpose of this feature of the report to make clear the point of view from which this task was approached and to describe the manner in which compensation contracts have been made so far as the Postmaster General has undertaken contractual relations with the owners of these properties. Four general statements may be submitted as indicating the point of view from which just compensation was regarded.

In the first place, it should be noted that the Wire Control Board, in its preliminary discussion of what constitutes just compensation, took administrative notice of the fact that Congress refrained from the expression of any rule by which just compensation should be determined. In this regard, the joint resolution, which authorized the President to take over the telegraph and telephone properties, differed from the congressional act which authorized him to undertake the operation and management of the railroads. In this letter case, it was distinctly stated that the average operating results of the three years of 1915, 1916, and 1917, should be accepted as a very important fact, if not, indeed, the ruling consideration in the determination of just compensation. It was early discovered by the board in charge of telegraph and telephone properties that the operating services of these three years were so different that the average financial results could not be accepted as final in the matter of compensation. While, therefore, this average was always in mind, it was not accepted as controlling.

In the second place, the board in charge of these properties took administrative notice of the fact that the phrase used in the resolution was "just compensation." Whether intended by Congress or not, the use of this phrase was interpreted as meaning that equitable and fair business consideration should control the determination of the compensation to be paid rather than those legal and more or less technical considerations involved in the rulings of courts and public service commissions in dealing with the problem of reasonable rates.

While no formal rule was laid down by the Wire Control Board, it did accept as a general principle for the control of its negotiations the proposition, that the companies whose properties had been taken by the Government were entitled to receive as compensation for the use of such property an annual payment which truly measured the stable earning capacity of the property. Every pertinent consideration bearing on this point was recognized and given its due weight. It was attempted as near as possible to arrive at the true rental value of the property regarded as an established going concern.

The above rule, or rather point of view, however, was subject to modification in two particulars:

(*a*) In the case of voluntary sale or rental of a commercial property, an owner might insist on the present value of the probably future increase in business in arriving at the amount to be paid as well as the earning capacity of the property. This consideration was not allowed, partly because of its speculative character, but primarily because of the uncertain tenure of the Government. It was also believed that to grant the owners of the telegraph and telephone properties compensation based on this element of value, would be to relieve such owners from a war burden which rested in one form or another on all industries carried on during the prosecution of the war.

(*b*) The general rule laid down above was further modified to meet the case of properties in the enjoyment of unusual revenues or of profits manifestly excessive when tested on the basis of capital investments. It was recognized that the industries under consideration were public service industries; that such industries might lawfully charge no more than reasonable rates, and that the test of reasonable rates is a normal return on actual investment. It was further recognized that, in the case of properties whose operating results raised the suspicion that they were charging rates which in themselves were unreasonable, and that the permanency of such rates was due to some differential advantage in the conditions of operation, the Government had no right to recognize such differential earnings as the basis of compensation to be paid for the use of their properties. In such cases it was essential that an estimate should be made of their capital investment, and that just compensation should be computed on the basis of such investment.

The above consideration finds a pertinent illustration in the case of the Postal Telegraph-Cable System of New York. The earnings reported by this system of properties was $4,200,000 for the year 1917, and it was this amount which the company requested the Government to accept as the measure of its rental compensation. Any information regarding the true value

of the property was denied by the representatives of the company, and it was consequently necessary for the Wire Control Board to proceed on an estimate of its own.

An examination of the operating conditions of this property disclosed the fact that the Postal Telegraph System in 1918 carried $14,930,000 out of a total of $90,000,000 worth of telegraph business carried by all the companies of the country; that it maintained offices at about 2,500 out of the 25,000 places at which telegraph service is rendered; that it owned 30,000 miles out of the 200,000 miles of telegraph pole lines, and about 246,000 miles out of a total of 1,840,000 miles of telegraph wire in the country.

The amount set down as compensation for the Mackay companies was $1,680,000. This amount was arrived at in the following manner: The average value of the Western Union plant per mile of pole line is $759.24. Applying this to the Mackay companies' mileage of 29,763 gives a value of $22,597,260. The Mackay companies have 8.3 wires per pole on the average, as compared with 8 wires for the Western Union; and 66 per cent of copper wire as against 42 per cent for the Western Union. Making due allowance for all possible factors of higher value for the Mackay companies' plant, it was concluded that the value of these companies could not be put at more than one-fourth higher per mile of pole line than the Western Union. On this basis the valuation of the Mackay companies was placed at $28,000,000, and the $1,680,000 allowed as compensation is 6 per cent of this amount.

It is not clamied that $1,680,000 per annum is just compensation as a rental payment for the use of the Mackay companies. It was not possible, in the absence of information, to compute such compensation. It was expected by the Wire Control Board that this figure would be regarded as "unsatisfactory" to the Mackay companies and that appaeal would be taken to the courts for the final determination of "just compensation." As already stated, this case is cited as an illustration of a property whose earning capacity, as shown by the operating results of 1917, can not be accepted as the measure of the amount to be paid by the Government for the possession and operation of telegraph and telephone properties.

The Wire Control Board early worked out for its own convenience and for the information of the owners of telephone and telegraph properties a form of contract. This form of contract was followed in most of the compensation agreements made, with such modifications in each case as seemed proper under the peculiar conditions submitted. It will be found as Appendix B attached to this report.*

To understand the present condition, so far as compensation contracts are concerned, attention must next be called to certain orders that had been issued which involve the policy of final settlement. On April 9, 1919, the Postmaster General issued an order the effect of which was to release class D telephone companies from direct supervision and control. According to this order it was proposed that these companies should continue their operations under license. Paragraph 5 of this order reads in part as follows:

The acceptance of the license herein provided for by a Class D company shall

*TELEPHONE ENGINEER for January, 1919.

Statement showing the claims of companies with which compensation agreements have been made, as computed from the operating reports of the respective companies, and an estimate of such claims for companies with which no contracts have been made.

Companies	Net telephone earnings	Compensation	Surplus	Deficit
American Telephone & Telegraph Co., New York, N. Y. (Including Bell Telephone Co. of Nevada; Bell Telephone Co. of Pennsylvania; Central Union Telephone Co.; Cincinnati & Suburban Bell Telephone Co.; Chesapeake & Potomac Telephone Co.; Chesapeake & Potomac Telephone Co. of British Columbia; Chesapeake & Potomac Telephone Co. of Virginia; Chesapeake & Potomac Telephone Co. of West Virginia; Chicago Telephone Co.; Cleveland Telephone Co.; Cumberland Telegraph & Telephone Co.; Delaware & Atlanta Telegraph & Telephone Co.; Diamond State Telephone Co.; Home Telegraph & Telephone Co. of Spokane; Iowa Telephone Co.; Michigan State Telephone Co.; Mountain States Telegraph & Telephone Co.; Nebraska Telephone Co.; New York Telephone Co.; New England Telegraph & Telephone Co.; New England Telegraph & Telephone Co. of Massachusetts; Northwestern Telephone Exchange Co.; Pacific Telephone & Telegraph Co.; Providence Telephone Co.; Providence Telephone Co. of Massachusetts; Southern Bell Telegraph & Telephone Co.; Southern Bell Telegraph & Telephone Co. of Kentucky; Southern Telephone Co. of Indiana; Southern California Telephone Co.; Southern Massachusetts Telephone Co.; Southern New England Telephone Co.; Southwestern Bell Telephone Co. (Missouri); Southwestern Bell Telephone Co. (Illinois); Southwestern Bell Telephone Co. (Oklahoma); Southwestern Telegraph & Telephone Co.; Tri-State Telephone Co. (Colorado); Wisconsin Telephone Co.)	$55,863,733.25	$66,403,903.56		*$9,290,170.31
Aroostook Telegraph & Telephone Co., Boston, Mass.	27,867.54	27,983.00		115.46
Carroll County Telephone Co., Boston, Mass.	2,207.78	4,328.00		2,120.22
Carolina Telegraph & Telephone Co., Tarboro, N. C.	41,233.26	45,000.00		3,766.74
Central Home Telegraph & Telephone Co., Louisville, Ky. (Including Bowling Green Home Telephone Co.; Carrollton Telephone Exchange Co.; Cynthiana Telephone Co.; Frankfort Home Telegraph & Telephone Co.; Independent Long Distance Telegraph & Telephone Co.; Marshall County Telephone Co.; Mayfield Home Telephone Co.; Maysville Telephone Co.; Nicholas Home Telephone Co.; Owensboro Home Telegraph & Telephone Co.; Owenton Telephone Co.; Paducah Home Telegraph & Telephone Co.; Paris Home Telegraph & Telephone Co.; Russellville Home Telegraph & Telephone Co.; West Kentucky Long Distance Telephone Co.)	41,745.27	92,263.90		50,518.63
Citizens Independent Telephone Co., Terre Haute, Ind.	50,468.00	50,975.00		507.00
Commercial Telegraph & Telephone Co., Olney, Ill.	26,820.00	37,872.00		11,052.00
Consolidated Telegraph & Telephone Co., Thomasville, Ga.	927.81	11,888.92		10,961.11
Coos Telephone Co., Boston, Mass.	8,165.62	17,049.00		8,883.38
Dakota Central Telephone Co., Aberdeen, S. Dak. (Including Grant County Telephone Co.)	171,268.00	187,548.00		16,280.00
Dallas Automatic Telephone Co., Dallas, Tex.	20,361.21	16,666.66	$ 3,694.55	
Dallas Telephone Co., Dallas, Tex.	78,957.57	89,020.60		167,978.17
Fayette Home Telephone Co., Lexington, Ky.	73,365.00	77,199.00		3,834.00
Franklin County Telephone Co., Boston, Mass.	9,596.96	8,368.40	1,228.56	
Gainesboro Telephone Co., Cookesville, Tenn. (Including Doyle Telephone Co.; Glasgow Telephone Co.).	23,340.00	25,035.00		1,695.00
Granville Telephone Co., Boston, Mass.	14,473.98	13,616.97	857.01	
Home Telephone & Telegraph Co., Henderson, N. C. (Including Home Telegraph & Telephone Co. of Virginia.	79,357.95	58,343.00	21,014.95	

*This amount is the deficit less deductions on account of agreement made subsequent to date of contract.

Companies	Net telephone earnings	Compensation	Surplus	Deficit
Home Telephone & Telegraph Co., Fort Wayne, Ind.	$ 107,380.00	$ 100,000.00	$ 7,380.00	
Home Telephone Co. of Joplin, Kansas City, Mo.	52,742.00	87,411.00		$ 34,669.00
Interior Telephone Co., Grinnell, Iowa	7,080.00	6,418.00	662.00	
Kansas Telephone Co., Abilene, Kans. (Including Cherryvale Telephone Co.)	27,657.00	39,443.00		11,786.00
Kansas City Home Telephone Co., Kansas City, Mo. (Including Kansas City Long Distance Telephone Co.)	551,044.00	590,109.00		39,065.00
Kinloch Long Distance Telephone Co., St. Louis, Mo. (Including Kinloch Telephone Co.; Suburban Telephone Co.; Sedalia Home Telephone Co.)	455,963.00	528,660.00		72,697.00
Kinloch-Bloomington Telephone Co., Terre Haute, Ind.	39,786.00	30,371.00	9,415.00	
Liberty Telephone Co., Liberty, Mo.	7,718.00	6,608.00	1,110.00	
Lincoln Telegraph & Telephone Co., Lincoln, Nebr.	385,419.00	420,273.00		34,854.00
Louisville Home Telephone Co., Louisville, Ky.	136,957.00	207,403.00		70,446.00
Maine Telephone & Telegraph Co., Boston, Mass.	24,207.25	27,647.00		3,439.75
Moosehead Telegraph & Telephone Co., Boston, Mass.	8,694.89	13,469.25		1,774.36
Ohio State Telephone Co., Columbus, Ohio (Including Portage County Telephone Co.; Northern Ohio Telephone Co.; Citizens Telephone Co. of Berea; Nelsonville & Murray Home Telephone Co.)	1,250,958.00	1,643,081.00		392,123.00
Postal Telegraph-Cable Co. of Texas, Dallas, Tex.		31,057.78		31,057.78
Peninsular Telephone Co., Tampa, Fla.	119,741.00	114,800.00	4,941.00	
Petroleum Telephone Co., Oil City, Pa.	36,490.09	50,194.33		13,704.24
Piedmont Telegraph & Telephone Co., Atlanta, Ga.	42,663.63	36,987.90	5,675.73	
Streator Telephone Co., Streator, Ill.	13,103.00	12,566.00	537.00	
Texas Telephone Co., Waco, Tex.	80,795.00	99,987.00		19,192.00
Texas Long Distance Telephone Co., Waco, Tex. (Including Texas Toll Line Co.)	53,750.00	52,837.00	913.00	
Tri-State Telegraph & Telephone Co., St. Paul, Minn.	484,174.00	717,740.00		233,566.00
United Home Telephone Co., Muskegon, Mich.	52,509.00	53,728.00		1,219.00
Union Telephone Co., Owosso, Mich.	52,260.00	77,344.00		25,084.00
Wabash Valley Telephone Co., Terre Haute, Ind.	19,438.00	19,615.00		177.00
White Mountain Telegraph & Telephone Co., Boston, Mass.	9,494.73	10,913.38		1,418.65
Western Union Telegraph Co., New York, N. Y.	9,991,334.00	10,913,045.00		921,511.00
Total	$70,387,532.65	$83,055,769.65	$ 57,428.80	$11,475,665.80
				57,428.80
Deficit for contract companies as per company statements				11,418,237.00
Estimated deficit for other companies				3,000,000.00
Total deficit				$14,418,237.00

operate as a waiver to any claim it may have for compensation under the joint resolution of July 16, 1918, for the use of its lines or systems during the entire period of Government control.

This order, in effect, gave to Class D telephone companies their net income during the year of Federal control as their compensation.

On June 4, 1919, the Postmaster General issued another order which contemplated the same purpose. The following is quoted from such order:

To each telephone or telegraph company, including individuals or partnerships owning wire systems, with which the Postmaster General has not made a compensation contract or made an award as compensation because of the use, possession, control, and operation of its wire system by virtue of the joint resolution of Congress of July 16, 1918, and the President's proclamation of July 22, 1918, an award is hereby made of the net earnings thereof arising out of the use, possession, control, and operation of same during the period of Government control, such award being made as just compensation for the supervision, possession, control, and operation of its system of the United States since July 31, 1918.

On September 29, 1919, an announcement was made which gave another option to such companies as had executed no contracts or to whom no award had been made as just compensation. This statement is given in full as an expression of the policy accepted by the telegraph and telephone administration in the matter of compensation awards and settlements:

BASIS FOR DETERMINING JUST COMPENSATION TO OWNERS OF TELEPHONE PROPERTIES WHO HAVE NOT EXECUTED CONTRACTS AND TO WHOM NO AWARD HAS HERETOFORE BEEN MADE.

In determining just compensation to the owners of telephone systems who have not signed a contract for such compensation for the supervision, possession, control, and operation of their properties during the period of Federal control between August 1, 1918, and July 31, 1919, the following will be used as a basis:

I. Any owner who so elects will be allowed as just compensation the actual earnings of the property during Federal control. This is in accordance with Orders No. 2980 and No. 3175. The term "actual earnings" as here used means gross operating revenues, less amounts charged as operating expenses (including depreciation), taxes, and rentals.

II. Any owner, the operation of whose property during the period of Federal control resulted in a deficit who so elects, will be allowed as just compensation an amount sufficient to cover the deficit. In determining this deficit the depreciation allowance to be included in operating expenses should not exceed a reasonable rate on the investment; but in no case should the rate of depreciation exceed the per cent which the amount that might have been used to cover depreciation during the pre-war period bore to the investment of that period, i. e., not to exceed the earnings available for depreciation during the pre-war period.

III. Any owner who does not accept actual earnings as provided for in Paragraph I, or an amount sufficient to cover deficit, as provided for in Paragraph II, will be allowed as award for depreciation and just compensation, an amount which shall give a rate of return on average fixed capital during the period of Federal control equal to 93.82 per cent of the per cent of the system's average net earnings on average fixed capital during the pre-war period.

The phrase "pre-war period" as here used means the three years ending December 31, 1917.

The term "net earnings" as here used means the remainder of gross operating revenues after deducting operating expenses (excluding depreciation), taxes, and rentals; that is to say, before deducting depreciation charged to operating expenses during the pre-war period and before deducting interest charged during that period.

The 93.82 per cent named above is computed from a study of the compensation and depreciation allowed those owners of telephone properties who have concluded compensation contracts with the Postmaster General. It represents an allowance as compensation and depreciation of 93.82 per cent of the same percentage of return on average fixed capital during the period of Federal control, as was earned by the system as "net earnings" on their average fixed capital during the pre-war period. Its purpose is to accord owners with whom no contracts have been made that elect this option, the same relative treatment, measured on the basis of invested capital, that has been accorded under the contracts for compensation heretofore entered into.

IV. Owners who elect to accept compensation under Paragraph III above do so with the following proviso:

In case the reduction in earnings, or the increase in the deficit, during the period of Federal control as compared with the pre-war period, is found on investigation to be due to changes in accounting or changes in policy, or to negligence or mismanagement, the Postmaster General reserves the right to award as just compensation the actual earnings or an amount sufficient to cover the deficit, whichever may be pertinent to the case in hand.

One further fact must be noted before submitting a statement of the present situation with regard to compensation and settlement. In the order of June 4, 1919, which offered companies there net earnings during the Federal year as just compensation it was provided that any claim for special consideration because of peculiar conditions would be considered

by the Postmaster General, if notification of such claim were submitted on or before June 20, 1919. It was further provided that any company which so desired might have a hearing before the Postmaster General or his duly authorized representatives prior to the fixing of compensation.

In the table submitted below will be found a statement designed to show the present situation with regard to compensation contracts:

Telephone and telegraph companies under Federal control.

	Companies under Federal Control	Contracts made	Accept earnings under Order 3175	Decline earnings under Order 3175	No response to Order 3175	Contracts to be made
Telephone companies:						
Class A	61	46	3			12
Class B	165	39	27	306	371	99
Class C	755	22	167			171
Class D	171	.....	.....	171	.....	171
Total	1,152	107	197	477	371	848
Telegraph companies	14	3	9	.....	2	2
Total	1,166	110	206	477	373	850

FINANCIAL RESULTS.

FINANCIAL RESULTS.

It is manifestly the desire of Congress to have at this time a statement of the maximum obligation which the companies may claim as a result of the operation and control of their properties. Such a summary is found in the tabulated statement above inserted, This statement shows the net earnings, the compensation allowed, the surplus or the deficit resulting from the year's operations of all companies with which contracts have been made. The reports of these companies cover 94 per cent of the net telegraph and telephone earnings of the country.

The statement also presents an estimate of the net deficit of all companies with which contracts have not yet been made. This includes those which have accepted their net earnings in lieu of compensation, those which have refused to accept their net earnings as compensation, and those which have made no reply as to the acceptance of their net earnings as compensation.

From the above statement it appears that the deficit of companies with which contracts have been made is $11,418,237, and that the estimated deficit of the remaining companies is $3,000,000, making a total of $14,418,237. This is the maximum figure, subject of course to correction through audit, which can be claimed from the Government arising out of compensation awards and the operation of the properties.

If the unadjusted claims of the Government against the Mackay companies be taken into consideration, the estimated obligations of the Government above submitted would be substantially reduced. The amount due by the Mackay companies being the excess of the estimated earnings of these companies over the compensation award is $2,123,392.56. This amount, or some approximate amount equal to the difference between what may be judicially determined as just compensation and the actual net revenues of the Federal year, expresses the claim of the Government against these companies.

The claims against the Government will be further reduced by the net profits, if any, on ocean cables during the six months that the Government was in possession and control of these properties. No statement has yet been received from these companies showing the financial results of their operations and consequently no estimate of the amount involved is submitted in this report.—A. S. BURLESON, Postmaster General.

India is extending its telephone lines until it has built one 600 miles long and another with a length of 300 miles is in service.

Miss Elizabeth G. Hunter of Boston recently received notice that she has won an official citation from General Pershing for unusually meritorious service as a telephone operator in the battle zone. She holds the distinction of having advanced closer to the German lines during hostilities than any other woman in the A. E. F. Before the war she was an operator in the Melrose exchange, Boston, and is now at the Quincy exchange of that city.

First Storms of Winter Do Much Damage

More than 5,000 telephones in central Indiana were put out of commission by severe wind storms last month it was estimated after reports made by exchange managers were compiled. Fifteen hundred poles were broken in the territory swept by the storms. The total damage is estimated at $75,000.

Telephone trouble crews worked until late at night clearing roads which were blockaded by fallen poles, and were on duty all day Sunday making repairs in city and county. Reports from various sections of the state indicate that toll lines were the hardest hit, city telephones escaping serious damage.

Extent of the damage suffered by the Michigan State Telephone Company is estimated at more than $200,000. Upwards of 30 miles of pole lines were broken down between Pontiac, Port Huron, Mt. Clemens and other suburban towns. The service in Detroit was not so severely affected because of the extensive underground system.

The Southwestern Bell Telephone Company states that service over wires of the company in Kansas, Oklahoma and Texas were badly demoralized and great damage done.

Reports state that in the Kansas City district more than 3,000 telephone poles were down as a result of ice forming on the wires. The toll line of the company from Kansas City to St. Joseph was down in numerous places and residence telephones in both cities were out of order.

Telephone Patrons' Union Completes Organization

Samuel Lewis Shank, former mayor of Indianapolis, was elected president of the Telephone Patrons' Union at a meeting of the board of directors held in the Baldwin Block. The union has been organized by a number of citizens to combat increased rates for telephones.

Dr. M. J. Spencer was elected first vice-president; Col. Russell B. Harrison, second vice-president; Joseph P. Rolles, secretary; H. H. Woodsmall, treasurer; Dr. Joseph L. Conley, chairman of the board of directors, and T. Ernest Maholm, general counsel.

Norfolk Bell Exchange is Automatic

Chesapeake and Potomac Company Cut Over to Machine System

AT midnight on Saturday, November 8, the Chesapeake and Potomac Telephone Company's automatic exchange, serving the city of Norfolk, Va., was cut in service, the event being one of the most successful ever conducted by the engineers of the Automatic Electric Company. The system thus placed in service is considered one of the most complete and modern automatic telephone exchanges in the world, no detail of construction or equipment having been omitted.

A total of 11,500 lines were converted, making this the largest single office automatic cut over ever undertaken, and the elapsed time from the cessation of service at the manual board to the first routine call through the automatic equipment was two minutes and ten seconds.

The Norfolk exchange has 11,500 lines of automatic equipment installed, to handle all traffic over the company's 13,500 stations now in service in the central portions of the city and has an installed capacity sufficient to meet the anticipated growth to January, 1922, when, development studies show, the number of stations will be slightly over 20,000.

Of this equipment 4,600 lines handle individual service, 4,800 are for two-party lines, which are equipped with harmonic bells, giving selective ringing, 400 lines are equipped for P. B. X. trunks, 300 lines are for pay stations and 1,400 lines for metered service.

The primary line switch units are equipped with four master switches each, giving 40 per cent trunking to the secondary line switches, reached through an intermediate distributing frame. The secondaries have 10 per cent trunking to the first selector switches, also reached through an intervening intermediate distributing frame.

The Norfolk system is of the 100,000 number type using five digits in each regular subscriber's number. The main line, P. B. X. lines and pay station lines are in the 20,000 group —reached from the second level of the first selectors. The two-party lines are in the 30,000 group.

The first level of the first selectors is used for special service; fire (101) and police calls (102), information (1202), complaint (1101), wire chief (111), reverting calls (181 and 182), inspector's ring back numbers (107-108) and rural operators' position (118). The operator at Chestnut is reached by dialling 16, Holly and Pig Point 17, and Juniper 15.

The tenth level ("O") is used for trunks to the long distance recording positions. The sixth level gives access direct to the Berkley operators, and "7" leads to the Portsmout switchboard. The Naval Base and ocean view are reached by dialling "9".

The fourth, fifth and eight levels are left free for growth either in the Norfolk area or in the surrounding territory. The system is designed so that at any time additional offices can be connected and existing manual boards converted to automatic operation, so that ultimately the entire region can be made into one coordinated system, every point of which can be reached by dialling, either directly by the subscriber, or through an operator for toll checking purposes.

The automatic equipment is connected directly to the toll board, the position of which are fitted with dials so that the operators call subscribers wanted on incoming long distance calls, automatically. The trunks from the Portsmouth and Berkley exchanges of the Norfolk area terminate on first selections in the Norfolk office, thus enabling the originating operators to complete calls direct by means of dials fitted at their positions.

Provisions usual in automatic exchanges are installed to handle fire, police, information, complaint and rural calls. Calls from pay stations are completed manually, but calls to them are made automatically by the subscribers.

In addition to furnishing the automatic equipment, Automatic Electric Company manufactured and installed a four-position test desk, an eight-position information desk, four-position repar desk and an 18-position pay station, rural A-B toll and official P. B. X. trunk board.

The equipment is installed in the Chesapeake and Potomac Company's new building in West Bute Street, which extends through to York Street, and also accommodates the business office and will later house the long distance operating room.

The structure, which is of red brick with white marble trimmings, is of the highest type of fire resistive construction. It was erected in record-breaking time and during a period when labor and material conditions were anything but normal. The first steel columns were placed on February 5, 1918, and the building was ready for the installation of the automatic central office equipment on May 15, 1919. It rests on concrete piles and the foundation and steel framework are designed for an ultimate height of six stories. At present the building is three stories high on the Bute street side and two stories on the York street front.

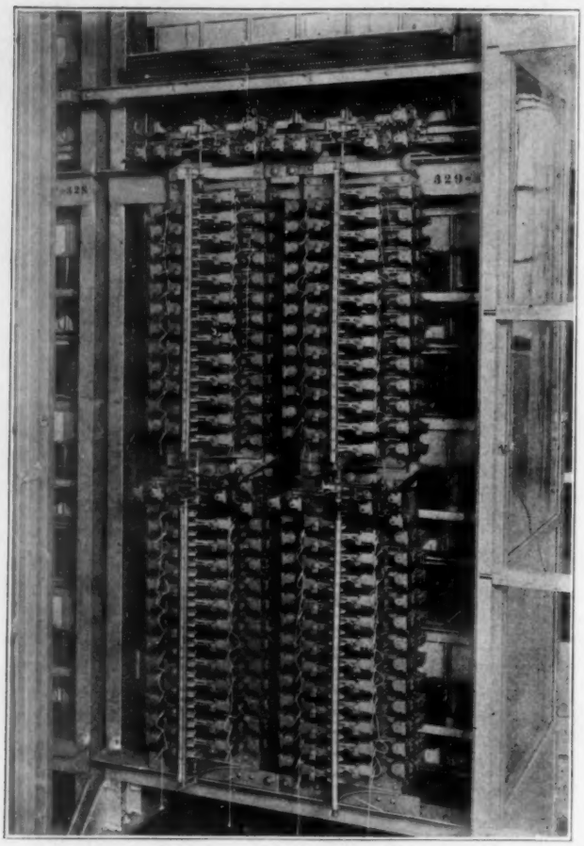
The Bute Street front of the building on the first floor is given over to the business office, all arrangements having an eye not only to the best and most modern appliances for the efficient and expeditious transaction of business, but to the health and comfort of the clerks and other employes as well. The aesthetic side was not lost sight of in making the office appointments, the furniture and everything else connected with its accommodations being things of beauty. The remainder of the first floor is occupied by the power plant and the heating and ventilation equipment.

An air conditioning apparatus is installed, which supplies air of the proper temperature and humidity to the parts of the building in which the automatic appartus and the manual switchboards are located. The relative humidity will not be allowed to exceed 70 per cent.

The remaining space on the first floor is taken up by the boiler room, the coal storage room, the cable vault, the rest room for men employes, and the pump room, containing vacuum, compressor and water pumps.

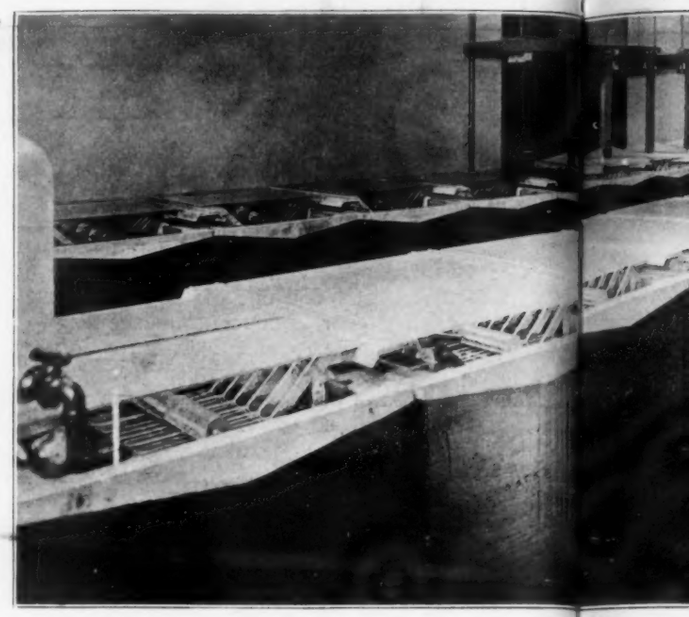
With the exception of a row of offices across the front of the building used by employes of the plant department, the entire second floor is used to house the automatic apparatus. In one large room are grouped the distributing frames, the test and repair desks and the automatic switches.

The third floor is to contain the manually operated switchboards, and

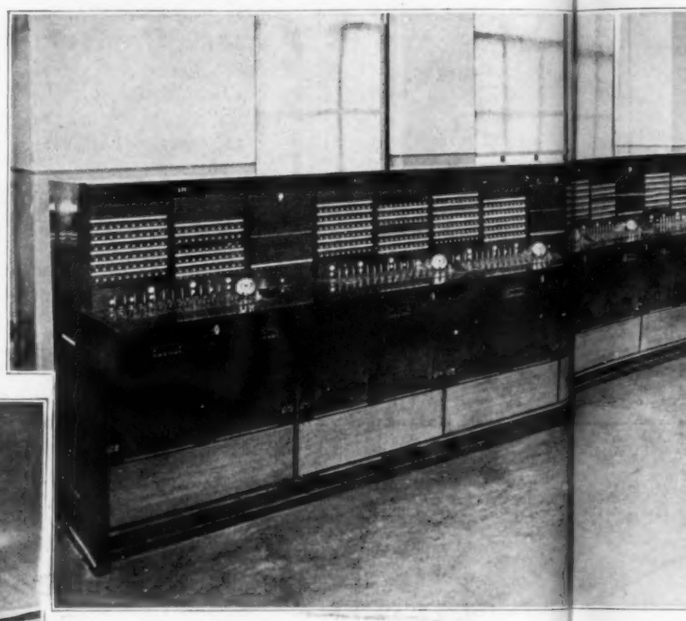


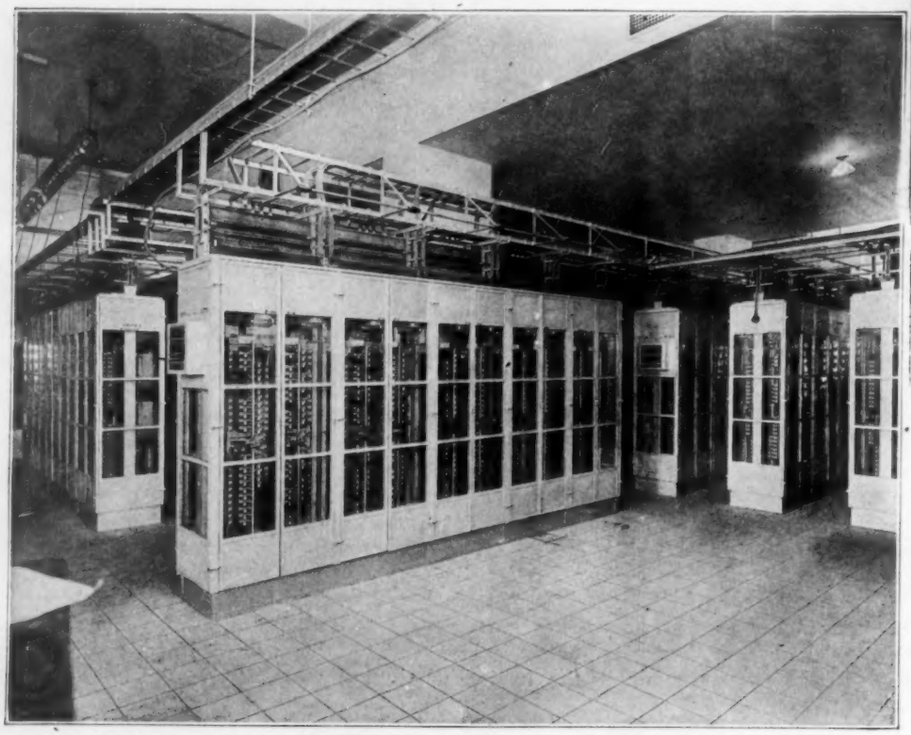
Above is seen a line switch unit (100 lines), with tooth picks in the line and cut-off relays, tied together ready to be pulled out at the cut-over signal. The primary line switch units are equipped with four master switches each, giving 40 per cent trunking to the secondary line switches, reached through an I.D.F. The secondary line switch units, seen below, have 10 per cent trunking to the first selector switches, also reached through an intervening I.D.F.

At the right is a view of the battery room. The counter cells are seen at the rear.

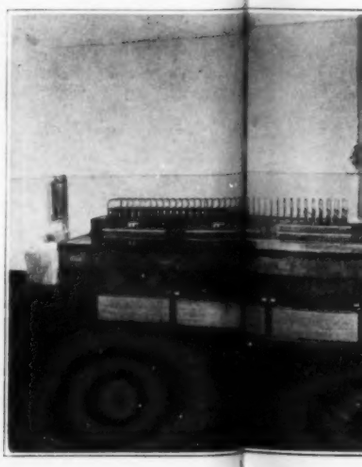


An 18-position pay station, rural, A-B toll and official P. B. X. trunk board, as seen at the right, is installed on the third floor.

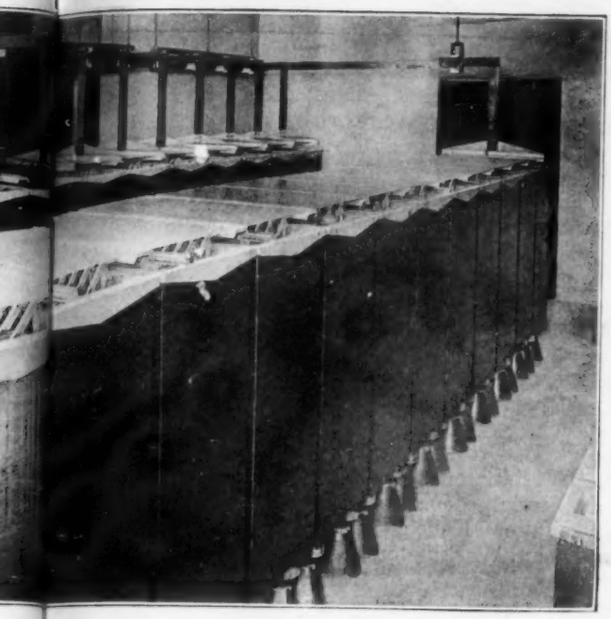




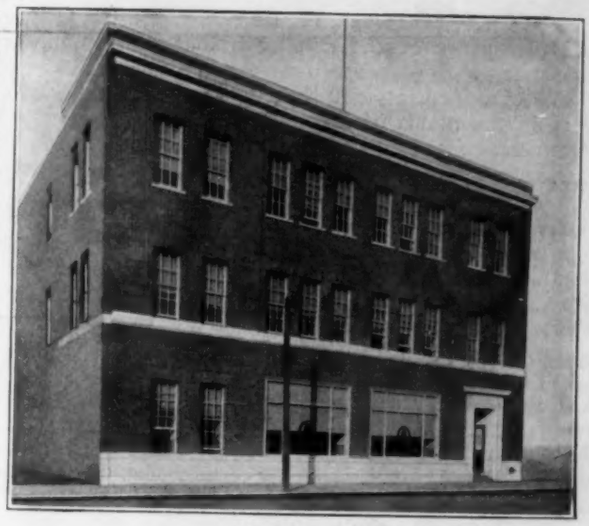
At the right is the eight-position information desk, also installed on the third floor of the new building.

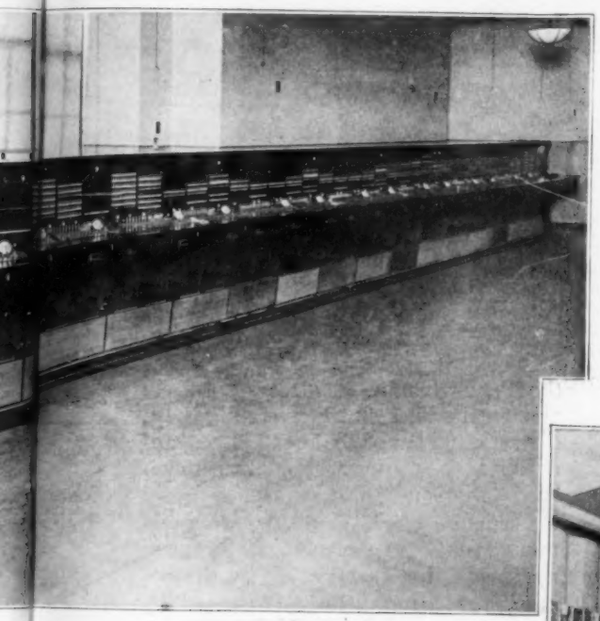


Norfolk, Virginia

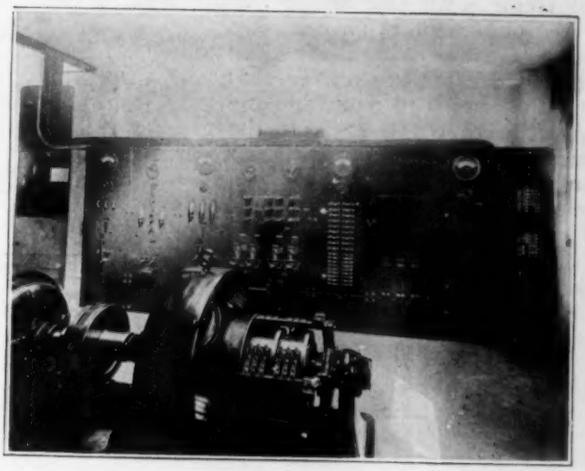


The Chesapeake & Potomac Company's new building, seen on the right, is of red brick with white marble trimminas, is of the highest type of fire resistive construction. It rests on concrete piles and the foundation and steel framework are designed for an ultimate height of six stories.

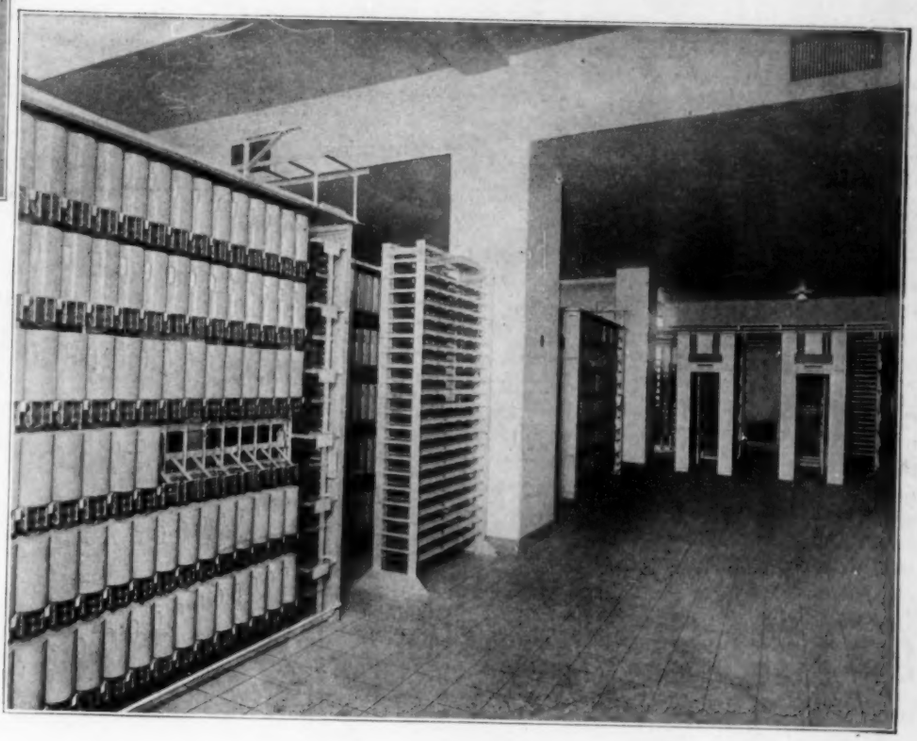




The big power board and motor generator, installed on the first floor, is seen at the right.



At the right is a view of one portion of the trunking switches, installed on the second floor of the new building.



Automatic Cut-Over

the operators' rest room, the cafeteria and the offices of the district traffic department.

The arrangements for the cut over were in the hands of a committee of engineers, consisting of Messrs. P. G. Burton, engineer, F. M. Craft, mechanical switching engineer, J. M. Richarson, plant superintendent, L. M. Simpson, district wire chief, George Small, equipment engineer, J. T. Graff, plant engineer, F. L. Fisher, equipment engineer, all of the Chesapeake and Potomac Telephone Company, and H. P. Mahoney, of Automatic Electric Company's operating department.

Previous to the cut, all lines and equipment had been thoroughly tested, and the cables leading to the old office half-tapped to the main distributing frame in the new building.

Beginning at 5 p. m. Saturday, the trunks from Berkley, Portsmouth and other exchanges in the Norfolk area, and the trunks to and from the toll board, were cut over from the old manual exchange to the automatic office, and at midnight the final step was taken, throwing all traffic into the new exchange.

The cut over of the local lines consisted of two parts, first, removing the heat coils in the old exchange main frame, and second, withdrawing the toothpick wedges in the line switch line-and-cut-off relays, which held the automatic equipment out of service.

Eight men were stationed at the old exchange, one in charge, one seated at a telephone in constant communication with cut over headquarters, and six men to perform the work at the main distributing frame. Their work was completed in 50 seconds. After the heat coils at the old office weer out, the jumpers were cut on the protector side of the main distributing frame.

At the automatic exchange one man was assigned to each 500 lines to remove the toothpicks; or 24 men for the line switches; one for incoming selectors and one for manual relay equipment, making a total of 26 men. All toothpicks were tied together in groups (four groups to a 100-line unit) and were withdrawn by pulling the tying strings. It requires 80 seconds to clear the automatic exchange after the signal was given.

The first call over the new system was made by Charles E. Ashburner, city manager of Norfolk, to C. Fred Bonney, district manager of the Chesapeake and Potomac Telephone Company.

The telephone company had taken particular pains to see that the public understood the method of calling by means of the dial, leaflets and advertisements being used effectively and extensively and special announcements in the press and by posters giving the date of the change in service. On the night of the cut over, steropticon slides were used in the principal theatres announcing the fact that the change would take place at midnight, and asking the public to use the new directory in making calls.

These notices naturally caused a very heavy traffic immediately after the cut over was completed, many persons sitting up until the announced hour to try the new service. The load, although very abnormal for that time of day, was well below the peak point and no difficulty was experienced. On Sunday the traffic remained relatively light, although remarkably heavy for a non-business day, but on Monday the full traffic, which is extraordinarily heavy for an exchange of this size, was placed upon the new system. That it is functioning satisfactorily is shown by the action of the Norfolk Chamber of Commerce, on November 18, in passing a vote of thanks to the Chesapeake and Potomac Telephone Company for the improvement in service brought about.

The cut over naturally attracted considerable attention among telephone officials and engineers, and a large group of experts from that section of the country were present as guests.

Among the out-of-town visitors were the following: J. W. Talbot, plant department, Washington; W. A. Tower, general superintendent of plant, Baltimore; R. L. Wright, division plant superintendent, Richmond; A. C. Stannard, general superintendent of traffic, Baltimore; E. F. Sherwood, vice-president, New York Telephone Company; P. G. Burton, engineer, Baltimore; C. H. Weber, division manager, Richmond; H. P. Charlesworth, equipment and transmission engineer, A. T. and T. Co.; W. A. Condit, division traffic superintendent, Richmond; L. M. Clarke, traffic engineer, Baltimore; J. A. Froelinger, traffic department, Baltimore; J. O. Martin, editor of the company's house publication *The Transmitter*, F. M. Craft, engineer of machine switching, Baltimore; B. Gherardi, chief engineer, A. T. and T. Co.; W. E. Farnham, local traffic engineer, A. T. and T. Co.; C. A. Berry, engineering department, A. T. and T. Co., J. T. Graff, plant department, Baltimore; H. M. Bascom, engineering department, A. T. and T. Co.; A. H. Moraweck, engineering department A. T. and T. Co.; W. Christiansen, engineering department, A. T. and T. Co.; C. B. Fowler, engineering department, Western Electric Company; E. R. Neir, superintendent of installation, Automatic Electric Company; R. Maetzel engineering department, New York Telephone Company; George Small, engineering department, Baltimore; A. F. Turner, publicity department, Baltimore; S. P. Shaw, traffic department, Baltimore; Earl Johnson, commercial department, Baltimore; J. C. Brown, commercial department, Washington; E. F. McNally, commercial department, Baltimore; J. Walter Kehoe, commercial department, Washington; J. L. Strieby, commercial department, Washington; P. J. Margeroth, H. M. Garrett, C. Birney and J. M. Boyer, engineering department, Baltimore.

Even New York Invaded by Automatic

The automatic telephone soon will be in general use in New York City and in other parts of the state. The New York Telephone Company announces that the new system is being put in at Dunkirk, Ithaca and Geneva. The machine switching apparatus will be used first in New York City in the Pennsylvania, Academy and Canal central offices, but the work in these districts will not be completed, according to present estimates, much before the end of the year.

Company officials said the new system would do away with telephone operators. In New York City the operating force has been increased by 2,000 new workers the last nine months, and the company intends to obtain 1,000 additional employes in the next few months. The force then will number 12,000.

Crawfordsville, Ind., is to have a new plant of the Central Union Telephone Company, within the next two years. The expenditure will involve $250,000. Twenty-five thousand dollars or $30,000 will be expended immediately to repair the present automatic system pending the installation of the new plant, which will require two years.

European Telephone Practice

Translations from the Foreign Press and Communications from European Engineers

By FRED W. SCHOLZ

The Care of Lead Storage Batteries.

THE life of lead storage batteries depends mainly on the care given them and the proper maintenance, granted that the material used in the batteries is of the correct standard. Aside from the necessity of keeping storage batteries in good condition in order to obtain the maximum efficiency in service, it is also important from the viewpoint of economy to keep their life of usefulness for a long period, since the replacement of lead storage batteries in large quantities is rather expensive. In view of the importance of this part of the equipment of the central office, a short review is here given, calling attention to the faults in the batteries and the possible disastrous results that might arise. While nothing new is given, the summary of points treating this phase of exchange management may be of interest to some of our readers.

Even before the storage batteries are brought into actual service, harm may have come to them through sulphating of the plates owing to a too extensive period of storage. This sulphating does not mean the ordinary lead sulphate which always results during discharge. The latter is a finely divided structureless filmy substance, while the dangerous sulphate consists of a coarse-grained crystalline powder, whose individual crystals lie very close together. These crystals are practically insoluble in sulphuric acid and offer a very high resistance to the electric current. The appearance of sulphating in any storage battery plates will immediately put the telephone man on guard for the corresponding phenomenon of the ordinary lead sulphate.

The negative plates, which as a rule are not formed in making the batteries, will contain lead sulphate, which has resulted during the process of manufacture through the union of the lead compound and sulphuric acid. The positive plates are usually shipped in a discharged condition. These will therefore contain a layer of ordinary lead sulphate. Both types of plates, however, may contain in spite of all attempts at dehydration slight quantities of sulphuric acid. If durin transportation there should be a small access of moisture to these plates it may even be the humidity of the air, then the production of crystalline lead sulphate is very likely.

Unless this is noted when installing the batteries and the proper steps are taken to offset this harmful condition, the capacity of the batteries will be decreased to a considerable extent. It is therefore advisable when installing new storage battery equipment to wait with the delivery of lead plates for the batteries to the exchange until the batteries can be installed immediately upon receipt from the manufacturing plant.

Great care must be given to the first charging operation after the batteries have been placed. The duration of this charging time with the charging current to be used is commonly given to the exchange by the storage battery manufacturers. Keeping this charging period and charge current strictly within the limits set by the manufacturers is of great importance in order to obtain a sufficient forming of the plates. If the first charge is insufficient, the capacity of the cells is considerably lower and later it is difficult, even when using long periods of excess charging, to bring the batteries up to their full capacity. In such cases it is also very likely that trouble will be experienced in regulating the density of the acid, possibly because all of the lead sulphate has not been transformed.

In all later charges the storage batteries should receive a current the quantity of which is higher by 10 to 20 per cent than that which was taken from the batteries at the previous discharge period. An extensive practice of keeping below this limit is just as harmful as one going beyond this limit. If charging is done with too small a current, it is impossible to transform all of the lead sulphate formed during discharging, into the lead peroxide at the positive plate and into porous lead at the negative plate. The ordinary lead sulphate which is left over gradually changes at both plates into the crystalline lead sulphate. Sulphation increases in proportion as the charging current is too small. If no steps are taken to check this process, the capacity of the batteries will decrease. The cause for this drop is due to the fact that the crystalline lead sulphate does not participate any more in the chemical changes accompanying charging and discharging, which is equivalent to a loss in active material.

An insufficient charging may take place if no attempt is made to see that both plates, positive and negative, show a good strong development of gases. As evolution of gases is seen first at the negative plates, careless treatment of the positive plates would lead to a state where these latter are not charged enough. But insufficient charging may occur just as easily if the attendant tries to rely entirely on the showing of the various meters in the storage battery room. If these meters show values that are too high, they become the causes for insufficient charging. These various instruments are subject to electrical and mechanical changes and inaccuracies. These latter, which do not always show, may lead to poor service of the batteries. It is better by far to watch the plates themselves and to see that they show a strong evolution of gases.

Overcharging the cells, i. e., passing too intense a current through them, is just as bad from many viewpoints. First of all, it means nothing but a waste of valuable current with increased costs for which there are no returns. In addition, excess charge current leads to a heavy decrease of the active mass of the positive plates, since the long-extended, powerful evolution of gases leads to a loosening of the structure of the lead plates. This gas evolution tears off small particles of matter from the plates and settles them at the bottom of the cell in the form of a slimy mass. In order to avoid the shortening of the life of the cells through this cause, steps must be taken to reduce the charge-current intensity by one-half, as soon as the gas evolution reaches too violent a stage. Just as electrical instruments that indicate too high a current lead to insufficient charges, so instruments that do not show enough current lead to excess charges.

Poor terminal connections with the batteries and the instruments may lead to wrong metering of current and poor service of cells. It is therefore

advisable to test the terminal connections from time to time and to tighten them where necessary. Observation of gas evolution, acid density and voltage will be good indicators as to the proper working of the cells.

Of great importance is the proper showing of the ammeters in order that the batteries are not charged with too powerful a current. The safest maximum current is stated by each manfacturer of cells, and should not be exceeded under any circumstances. If this is done in spite of warnings, there will result an irregular transformation of lead sulphate into lead peroxide. As a result the cohesion between the active mass is loosened and in the course of time the positive plate bends and twists. As the transformation of the active mass when using too high a current takes place only on the surface of the plates, the full capacity of the batteries cannot be obtained either. Moreover, owing to the increased current tension, the useful effect of the batteries is lowered.

Finally, it should be mentioned that using too intense a current for charging will favor the production of persulphuric acid. This acid is very injurious to the plates, as it affects the lead and causes a rapid decomposition of the same. In order to avoid charging with too high a current, most exchanges will have mechanical and electrical equipment which will make it impossible to use too intense a current.

The acid density of the cells should not be more than 1.20 after charging is completed. A higher density is not advisable, as increased density of the acid increases the solubility of the lead sulphate and consequently hastens the danger of sulphation. Impurities in the sulphuric acid and in the distilled water are also harmful to the batteries.

Above all, there should not be the slightest traces of arsenic, platinum or copper in the liquid. Care should therefore be taken to see that no drops of moisture form along the discharge conductors, which when falling into the cells might pass minute particles of copper from the wires into the acid. Iron and chlorine also have an injurious effect on the acid. No metal rods of any kind should be dipped into the acid, not even to see the depth of the liquid.

Coming now to the mistakes to be avoided in discharging, we may state first of all that discharging should not be carried on to too great a stage. The increase of traffic or addition of more lines often leads to a discharge of the cells to too great exhaustion. If this is done for any considerable length of time—and it may be done for a long time, before the minimum voltage of 1.8 is reached—the cells do not seem to suffer to all appearances. But this is only seemingly so, for in reality the results will soon show at the positive plates. These latter will gradually decay. The deeper the cell is discharged the more lead sulphate is formed, whose volume is greater than that of the peroxide of lead. The mass of the positive plates is loosened to a very large extent and the gas evolved during discharging can tear away large masses of the plates. This shortens the life of the plates.

The strong change of volume of the positive plates besides leads to a spreading and growth of the plates. If there is no room for expansion in the containers, the positive plates will curve and will finally draw the negative plates into the trouble.

Finally it should be noted that the lead sulphate, which under these conditions is formed in large quantities, does not conduct current as well and leaves only an ever-decreasing mass of material which is a good conductor of electricity. Sulphation also increases in proportion as the finely divided lead sulphate is present in large quantities. Discharging must therefore be interrupted regardless of the terminal voltage shown by the instruments. Discharge-current electric meters may help to ward off this trouble, but they should never take the place of watching the specific gravity of the acid in the cells by proper tests.

Care should also be given to batteries which are connected either in parallel or in series and which may suffer through poor contacts at the springs or at the terminals which lead to the wires. Sometimes poor contacts will increase the resistance for individual cells beyond the safety limit. Those cells whose resistance is lowered discharge current very rapidly and may quickly drop below the permissible limit for discharging. If it is noted that certain cells lag behind in evolution of gases, the contacts of all switches connected to the storage battery equipment should be cleaned, the springs should be tightened as regards tension, and the terminals leading to the wires tightened.

Letting the cells stand in a discharged state is especially harmful and must be avoided by all means, as the soft lead sulphate would change into the crystalline sulphate and the storage batteries would lose in capacity.

Too small a discharge of batteries is rarely found, as most exchanges install storage batteries in keeping with their service needs. At the worst there might be certain sets of batteries that would not be placed into service until the traffic demands it. Should this take place, however, it would lead to sulphation of the inner parts of the plates, which would lead to a loss of capacity. In addition the positive plates will gradually curve, or "buckle" owing to the irregular transformation of the lead peroxide into lead sulphate.

Discharging the plates with too intense a current is hardly to be feared in telephone exchanges. The results would be clogging of the pores of the plates and the formation of lead sulphate only at the surface of the plate. The inner layers do not take part in the transformation, as the acid only attacks the outer layers. The batteries therefore cannot furnish the maximum of current. The sudden and strong change of volume of the outer layers would also lead to a curvature of the plates and falling off of active material. The life of the batteries decreases very quickly.

The harm caused by short circuits needs hardly a word. Short circuits are bound to be noticed with even the slightest care. Even when charging it will be noted that a short circuited cell lags in the evolution of gas. What has been said about other injuries to the cells through careless treatment also applies with equal force to short circuits.—*Fernsprech Technik.*

* * *

Testing Equipment in Large Telephone Exchanges

(Concluded)

Test Equipment for Incoming Lines: The diagram for the wiring for incoming lines is shown in Fig. 1, and includes a wall and desk set, three throw switches *H1, H2, H3*, two call relay sets for subscribers' lines with and without inter-office equipment, the switch *UIV*, various relays with the necessary resistances, visible signals and condensors. There are also 9 jacks at the main distributing frame and the necessary test cords, which are shown in the upper part of the diagram.

Testing is done in various ways, depending on whether the A-exchange (exchange sending out the call) is a local exchange or long distance exchange, and uses the two or three wire system. The four-way switch U*IV* at the center of the diagram is used to connect the exchange equipment either for an ordinary c. b. subscriber's set (switch thrown to the left) or else for a subscriber with current feed over the b-branch of the line (*UIV* thrown to the right and *H2* up).

Lines which go out from an A-exchange are operated on the outgoing side by means of optical signals. The a-branch of the trunk wire has been connected in the A-exchange by way of the optical relay to earth and in the B-exchange it has been connected with the common battery. The optical relay will attract its armature and the corresponding lamps will remain dark in the rest position.

1. The inspector or operator making the test of the line plugs the jack *k1* with his read plug and places the corresponding six-part test plug into the jack of the line to be tested. The lamp *OL* will immediately go out, as the line now is without current. The current flow is as follows: Ground, right springs *5* and *4* of *H1*, optical relay *OR*, switch *H1* (spring *3* and *2* on the left), terminal *1*, a-spring of jack *k1*, six-part test plug, a-branch of the trunk line, choke coil *11*, first left armature and back contact of *SR1* back contact and first right armature of *HR*, common battery, earth.

The *CR* of the test equipment therefore attracks its armature and the current which flowed so far from the negative pole of the common battery by way of the armature and the back contact of *OR*, through the lamp *OL* and by way of the springs *5* and *4* (left), from *H1* to earth, ceases to pass, so that the lamp *OL* is extinguished.

2. The lower *H1* is thrown into the upper position. The lamp *OL* lights, because the relay *OR* is cut off from the trunk line. The a- and b-branch of the trunk wire must be fed with current from the A-exchange. The current in the b-branch causes the calling of the B-exchange. Current flow—pole of the common battery, choke coil *d1*, switch *H1*, terminal *2*, b-spring of the jack *k2*, test cord, b-branch of the trunk line, relay *HSR*, earth. Current flows through *SR1* to earth by way of the armature of *HSR*. The second left armature of this relay causes the lighting up of the call lamp.

The a-branch of the trunk line alone is fed by the current and the current path is as follows: Pole of the common battery, relay *SR2*, which replaces the cut-off relay of the A-exchange, switch *H1*, terminal *1*, a-branch of the trunk line, choke coil *11*, first left armature and working contact of *SR1*, insulated working contact of the third right armature of *HR*. The clearing lamp *SL2* must light up to show that the B-exchange has not answered as yet. The current flow will then be: Pole, armature and back contract of *SR2*, clearing lamp *SL2*, *H1* (springs *4* and *5* right) and earth.

When the call lamp lights up, the operator of the B-position in the exchange should answer. In order to test the correctness of this answer, the receiver of the battery set is taken off the hook. As soon as the exchange answers, the clearing lamp of the testing equipment (*SL2*) goes out, because the a-branch of the trunk line is grounded by way of the connections made by the operator at the exchange.

The inspector will now ask for a certain line, and as soon as the operator has placed the plug of the proper line into the corresponding jack, the call bell of the desk set will begin to ring at regular intervals. If the receiver is removed, the call ceases. At the same time the clearing lamp *SL2* of the test equipment goes out as an indication that the called subscriber has answered. This lamp goes out, because the a-branch of the trunk wire, when lifting off the receiver at the desk set in the B-exchange, is grounded. This grounding is accomplished by way of the armatures of the relays *SR1*, *HR* and *SR2*.

In order to test the proper effect of the flicker signal equipment, the operator at the B-exchange has to place the plug of the trunk cord into a flicker signal jack. The clearing lamp *SL2* of the test equipment must give the flicker signals in the usual way.

Finally, if the operator who makes the tests throws the switch *H1* back into the normal position, the lamp belonging to the line in question at the B-position will light up like a clearing lamp, which will cause the operator to take the plug out of the subscriber's jack and the pilot lamp which was lit up to this time will now go out.—*Fernsprech Technik.*

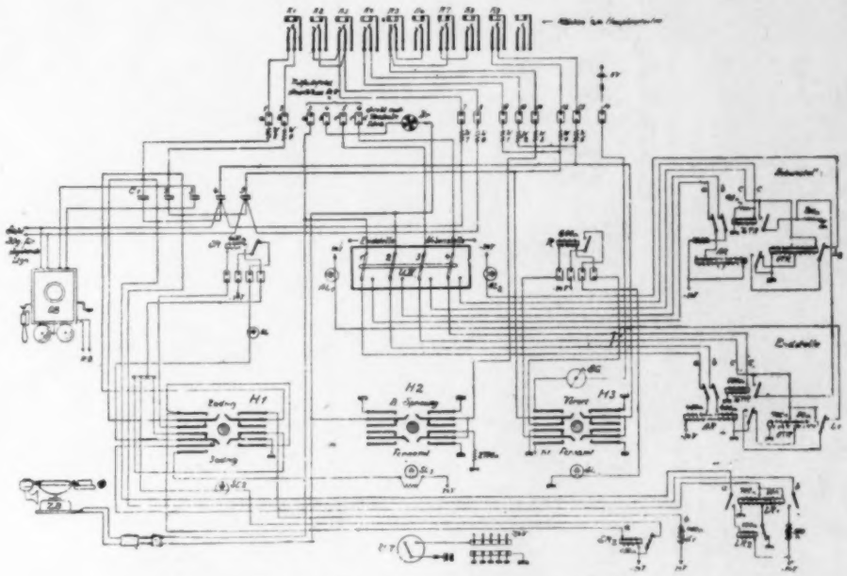


Fig. 1. Wiring Diagram for Testing Incoming Lines.

* * *

A Card Index System in the Telephone Exchange

As office systems are perfected more and more, and as they enter other fields besides the business office alone, the advantages of the card-index system become more apparent and lead to their introduction in all industries, where they replace the old-style books. The telephone exchange, among other plants, is one of the places where the card system can be of great usefulness and prevent much trouble and save much time.

It is quite apparent that the numerous subscribers' lines terminating in an exchange should be charted in such a way that they are easily located on

Operator's Switchboard No.	Position: Owner	Frame: From Frame to Cable No.	Frame: From Frame to Cable No.	Location: Cable No.	Location: Cable No.	Cable Conductor: Further to Cable No.	Cable Conductor: Further to Cable No.	Cable Conductor: or to Trunk Line	
Resistance:	Length of Line above ground ft. / below ground ft.								

Equipment	Location of	Wall Set	Table Set	Fuse Boxes	Fuses	Switches	Jacks	Lamps	Inter-mediate Distrib.		Dry Batteries	Notes
Main Trunk												
No. 1												
No. 2												
No. 3												

Notes as to Equipment, (E) Operation, (A) Changes (V) and Repairs (R) of Subscr. Tel.

E. A. V. or R	Year	Mo.	Day	by	E. A. V. or R.	Year	Mo.	Day	by	E. A. V. or R.	Year	Mo.	Day	by

Fig. 1. Card Index for Subscriber's Lines.

the exchange equipment, so that in case of trouble or disturbances the fault can be located and remedied in short order. If the various details of the different subscribers' lines are kept in bound or even in loose-leaf books, they will form large volumes, which can be used by only one person at a time. If the book is filled, a great deal of time is wasted, transscribing records into the new books all of which time can be saved by using the card system. There is hardly any need for pointing out the advantages of a card system from the standpoint of facility in handling, ease of finding certain cards and unlimited possibility of growth.

While our telephone exchanges in the United States have made use of card systems for some time, European exchanges have been giving this type of recording system only slight attention and several of the exchanges in larger cities like Amsterdam, Berlin, Hamburg and Dresden point with pride to their more modern system where card indexes are used.

For operating the local telephone systems, the Hamburg exchange, which is one of the best equipped ones from our American viewpoint, has numerous card indexes which are arranged so as to cover various purposes. The cards contain all kinds of information that might be useful for making repairs or installing new lines. They permit the location of each subscriber line according to call number, according to position in the local exchange, according to position on the main distributing frame and according to location of the home or office of the subscriber.

The most important card system which is the basis for all the others is the card system of the supervisor and trouble and repair chief. The cards are of yellow cardboard and 3x5 or 4x6 inches, depending on the use. There is one card for each subscriber's number and the cards are arranged by numbers. The upper space on each card gives space for the exact designation of the connection, which is indexed according to number, to location, to name and finally according to the line inspector's district, within which the line is located. In Hamburg the entire city is divided into districts and each is assigned to an inspector who has to take care of all repairs in the same and inspect the lines at stated intervals. The other matters that can be learned from the card are seen from the illustration.

The lower section of the card gives information about all points worth noting down in regard to the exchange. Whatever details may be of interest or of importance can be noted on the card. The last space for notes is left for indicating the number of extensions found in the office of the subscriber. The lowest third of the card allows notations as to equipment (E), changes (V) and regular testing (R) of the subscribers' telephones. In addition, the year, month and day when the telephone lines were installed and turned over to the subscriber are here indicated.

The reverse side of the card, shown in Fig. 2 has space for notations on disturbances and trouble on the line, or trouble at the terminal point of the line in the exchange. In case one card is not enough for all information, a second one or more

TROUBLE AND REPAIRS

Reported: Year	Reported: Day and Month	Switchboard	Extensions	In Subscriber Line: Interruption	Grounding	Loop Contact	Other Contacts	Cables and Wires	In Subscriber's Telephone Set: Safety Fuses	Lightning Arrester	Room Wiring	Ground Connect.	Batteries	Hook Switch	Bell Signal	Microphone	Receiver	Plugs	Buzzer Disc	Other Parts	Trouble Removed: Day	Trouble Removed: Time	Duration of Interruption: Hours	Duration of Interruption: Minutes	Tested

Fig. 2—Back of Card.

can be made out and fastened to the first one with clips. The notations as to number, name and location of the subscriber's lines are made in black ink, notations as to special wiring, special equipment and similar matters are made in red ink. All other notes are made in pencil. To keep the cards for about 40,000 connections a filing cabinet with 400 drawers is used, keeping 100 cards in each drawer. When a card has been removed, a colored substitute card, having a different color and showing the number of the removed subscriber, is substituted in the place of the original.

As soon as a post card is received from a subscriber showing that his line is out of order, or if he sends in the regular trouble blanks, which are furnished by the exchange to each subscriber, his card is removed from the file. The card is then tacked to the trouble post card or to the message taken down of the trouble, and given over to the chief who sends out the repairman to make the repairs. As can be seen from the cards, the information yielded is so complete that the repair chief can form a good idea of the nature of the line that is to be repaired and can locate the error much easier. Besides, past repairs may help him locate the present trouble much quicker than would be the case, if he had no such guide on hand.

The chief will then call one of his repairmen and give him whatever instructions may be yielded by the cards in regard to the repairs to be made. It is one of the rules that the subscriber's card must not be given to the repairman going out on the job. The card is kept in a special filing cabinet on the chief's desk and is only removed from there and put back in place in the permanent file after repairs have been made and the new notations taken down.

The second card index system in use in the Hamburg exchange files the subscribers by streets and location of the subscribers' telephones. Here also is found a card for each trunk and for each telephone which is not located on the same property as the principal switchboard. This might be the case in a factory which covers quite a little space, and has telephones in various buildings. These cards are much smaller and show the information as shown on Figs. 3 and 4, one of which is the front, the other the reverse side of the card.

The reverse side has space for notations as to the regular calls made by the repairmen in their rounds. The cards are arranged by streets, following the alphabetical arrangement of street names, and are again sub-indexed by house numbers in the various streets. It is therefore easy to find any card for any street. The repairmen are sent out on their rounds by streets and are given the numbers to be visited in rotation. This saves a great deal of useless running around, as it amounts to a practical routing of the work, reducing time wasted by chasing from one part of the town to another.—*Frensprech. Tech.*

No.	Position															
District	Owner															
Telephones	Wall Set	Desk Set	Fuse Box	Fuses	Switches	Bells	Jacks	Cords	Plugs	Batteries	Dry Elements	Receiver	Microphone			Notes
Trunks																Extensions
No. 1																
No. 2																
No. 3																
No. 4																

Fig. 3—Front of Card.

NOTES ON INSPECTION OF SUBSCRIBER'S TELEPHONES									
Tested	Year	Mo.	Day	by	Inspected	Year	Mo.	Day	by

Fig. 4—Back of Card.

Wapakoneta, Ohio, is to have a new telephone system of the semi-automatic type. It will be similar to that now in use in Lima.

Frankfort Council Grants Continuance of Rates

Telephone rates fixed by the United States government will be continued in Frankfort, Ky., for eight months from December 1, as the council in special session passed a resolution granting the telephone companies this privilege. In taking this action the council is following the rule of the United States Government and the State Railroad Commission. The increases in the rates which accrue to the company do not go to the stockholders but to the employes, and it was not until the companies had satisfied the members of the council on the production of the same proof that was submitted to the government that the council will grant this extension of time on the rates as they are now fixed.

The council, however, provided for the appointment of a committee from the new council which will investigate the rates and expenses of the companies and obtain such other information as will be necessary to report to the council on this subject in the near future.

Chesapeake and Potomac Wins Rate Contest

A victory was scored by the Chesapeake and Potomac Telephone Company of Virgina before the State Supreme Court, when the court refused to grant a writ of mandamus sought by the city of Richmond to compel the company to render service at prewar rates.

Big Improvement by Southern Bell

Anticipating further shortage and stringency in the matter of female help and labor generally, the Southern Bell Telephone Company, filing a report showing its plans for the expenditure of $9,000,000 in improvements in the state of Georgia in the next two or three years, has announced also plans already made for the establishment in the city of Atlanta of an automatic central exchange.

These two items are but features of a general outline of modernization development officially reported by the company, in pursuance of which there has already been, since the wires were turned back by the government, an expenditure of around half a million dollars in Georgia.

The company says for instance that the supply of female help is far below the demand for it, and no alleviation of that condition appears to be in early prospect. However, to develop as rapidly as possible that female help which is available, and properly to care for them and to hold them, vast housing plans as well as a large department of instruction, have been provided for in the city of Atlanta.

The company reports that it has leased, for a term of years, a modern apartment house—the "Oglethorpe"—in the city of Atlanta, at a rental of $6,300 a year, which it has entirely refitted and refurnished, at a cost of $31,000, where it will care for its "visiting operators" as well as such others of its women help as is necessary "at a very small cost." The plan as it is outlined, contemplates the provision of living quarters for these girls at a cost to them of approximately 71 cents per day, which the figures show will require an additional expenditure by or "loss" to the company of about $17 per month per person.

The apartment building will provide living quarters, thoroughly modern in every particular, for least 120 young women. The establishment will be in charge of and under the constant supervision of a trained matron.

In the development of that particular feature, the company announces that it has converted the entire third floor of its Ivy exchange building into a training school for operators, in which it has just installed a complete class room outfit at a cost of $23,000. In this department the "visiting operators," who come for the necessary instruction before being assigned to switchboard duties, will be given a thorough course of training, during which period they draw, as has heretofore been the custom, a fixed salary.

In respect to the female help, the report of the company says:

"Unfortunately increased wages do not today create new workers; it only causes the transfer of some workers. * * * The supply of women workers does not seem to exist."

Explanatory of this the report shows that under the more or less abnormal conditions which now obtain, the women workers are disinclined to Sunday or night work and, naturally, divert to another calling whenever the attraction is a greater inducement to them.

Forecasting the developments which the company has concluded will be necessary to meet this condition of things, the announcement is made of the early installation in Atlanta, at least to begin with, of an automatic or mechanical exchange, for which a tract of ground already has been bought on Auburn avenue, adjoining the Ivy exchange, on which to locate the new form central office. On this subject the report says:

"Early this year the decision was made to introduce mechanical central office equipment in Atlanta, and a lot has been purchased at a cost of $65,000 to house some of this equipment. Just when it can be in stalled for service is now a matter of factory development and production, but it is thought that this first equipment can be completed by the end of 1921 or early in 1922.

"We were forced to take this step, not because of any present economies, but solely for the reason that female labor is each year more averse to working nights, Sundays and holidays, and because in no other way does it appear possible for this company to render service in Atlanta, where the many demands for female labor in offices and other attractive lines of work, practically engage the available supply."

"Much has been accomplished," says the report in refering to the things which have been done since the wires came back into control of the owners," and more will be accomplished, but there is no hope of thoroughly clearing up the situation other than with the aid of mechanical central office equipment; at least to the extent of making up the deficiency in the supply of human operating skill."

There has been a gradual improvement made in the service being rendered, since the taking back of the lines by the owners, in Augusta, Albany, Athens, Columbus and other points in the state, says the report, and further improvements are to be made in those places. In the cities of Savannah and Augusta the service now may be termed "excellent," it says, while in Columbus, Athens and other similar points it is "good." The cities of Savannah, Columbus and Augusta, the report says, represent one-third of all the stations in the state.

In Atlanta, the report says, there have been improvements made, but the scarcity of operating help has brought that service only to the grade of "good" thus far. There has already been expended in the cities outside of Atlanta $187,000 on improvements, there is under plan proposed additional improvements which amount to $300,000, and $120,000 of new switchboard equipment is to be immediately installed.

The total work estimated and approved to be completed in the state of Georgia within the next three years, possible in the next two years, aggregate $9,000,000.

Missouri Bell Would Spend Five Million

At a recent rate hearing, J. J. Robinson, construction engineer of the Missouri Bell Company, testified that not less than $5,000,000 should be expended by the company in its replacement and extension program next year in St. Louis and throughout Missouri. He said that the 1919 program had contemplated an expenditure of $4,000,000, but it could not be carried out because of the fact that the labor could not be had.

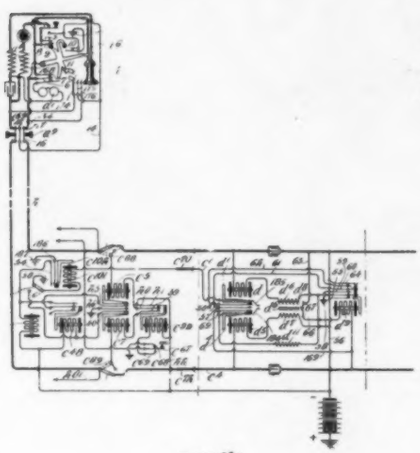
There must be a very large program he said, to keep pace with the generally increased demand for telephone service in the state. Robinson told of the wage increases of the company during the last few months. In 1914 the average wages a month in the construction department, in which 850 men are employed, was $63. Today the average monthly pay of the same employes is $97, and this will go within the next year to $110 or $115, he estimated.

Telephone Patents Recently Issued

A Brief Digest of the Most Interesting Current Specifications

By DAVID S. HULFISH

NO. 1,314,685. Trunking Circuits for Automatic Exchanges. Issued to T. G. Martin, assignor to Automatic Electric Company, Chicago, Ill. (Application filed May



1,314,685.

29, 1905.) The ninety-five claims, dating from the early application, cover several detailed circuits, the prominent feature being the use of a repeater at the first selector. Current is fed to the calling subscriber from the first selector, the line relays of which operate to repeat the signal impulses to the trunk conductor on the trunk side of the talking condensers.

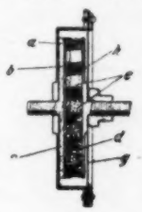
1,314,695. Composite Signaling Circuits. Issued to H. S. Osborne, assignor to American Telephone and Telegraph Company, New York, N. Y.. This invention elaborates upon the customary composite circuits whereby telegraphic work is carried upon the telephone wires. An artificial balancing line is provided in connection with the telephone line, and the telegraph circuits are connected to the line wires and to the wires of the balancing line as well, to secure greater perfection of balance in both telegraph and telephone circuits. The drawing shows a telephone repeating station, with talking circuits connected through the station, and with telegraph circuits working both ways from the station, two sets of artificial lines being shown.

1,314,711. Trunk Signaling System. Issued to A. B. Smith, assignor to Automatic Electric Company, Chicago, Ill. Signaling impulses are repeated over the trunk circuit by using the two speaking conductors in parallel, thus reducing the apparent resistance of the trunk circuit. The impulses are sent by reversing the current upon the trunk conductors and are received by a polarized relay, thereby increasing the reliability of the switches.

1,314,804. Automatic Disconnection Circuit. Issued to J. E. Hilbish, assignor to Kellogg Switchboard and Supply Company, Chicago, Ill. In connection with a magneto telephone line, the subscriber may release his connection by a cord-circuit relay without waiting for the operator to withdraw the connecting plugs, thus securing an immediate recall.

1,315,337. Transmitter. Issued to W. K. J. Rudolph, assignor to Signal Gesellschaft M. B. H., Kiel, Germany The improvement resides in the construction of the carbon cell. Upon one face of the cell is fixed a piece of velour cloth, cut with holes. The fine fibers of the velour extend across the cell and touch the opposite face of the other electrode of the cell. The holes in the velour thus form a number of compartments in which is placed the granular carbon, producing a multiple-contact instrument.

1,315,440. Busy-Test System. Issued to B. D. Willis, assignor to Automatic Electric Company, Chicago, Ill. When the toll operator calls a subscriber's line and receives the busy tone, she leaves the connection up, and a signal upon the toll board in-

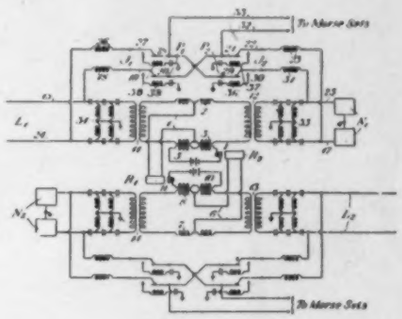


1,315,337.

dicates to her when the selected line becomes idle, thus giving her the line for the toll connection at the earliest possible moment without interrupting the previously existing conversation.

1,315,441. Phantom Trunking. Issued to A. B. Smith, assignor to Automatic Electric Company, Chicago, Ill. The signaling over the trunk conductors for the physical and phantom lines is done with tuned alternating currents, and the currents are received by tuned circuits and relays, thus separating the signals and giving the signals to their respective proper switches at the receiving exchange.

1,316,101. Signal System. Issued



1,314,695.

to T. G. Martin, assignor to Automatic Electric Company, Chicago, Ill. In the trunk circuit from the manual switchboard through automatic switches to a subscriber's line, the current in the trunk is reduced in quantity but is not wholly interrupted when the selected line is found, this reduction operating to give a signal to the manual operator. When the subscriber answers, the current is restored to full volume, thus extinguishing the signal at the manual switchboard to indicate the response.

1,316,704. Meter System. Issued to J. Erickson, assignor to Automatic Electric Company, Chicago, Ill. The meter is at the telephone, and is worked by the return of a push button, which must be pushed in before the subscriber can operate the dial effectively. The meter button then is released by the answering of the called telephone.

1,317,152. Callsender. Issued to J. G. Blessing, assignor to Automatic Telephone Company, Chicago, Ill. The telephone in this case is of the desk stand, or table type, and in the vertical column of the telephone stand is built a slider, with finger holes, which is pulled in a sliding manner to send the call signals. It is a sliding sender instead of a round revolving dial.

1,317,522. Line Switch. Issued to E. A. Mellinger, assignor to Automatic Electric Company, Chicago, Ill. (Application filed 1906.) This is one

of the earliest applications upon the well known Keith line unit, used by the Automatic Electric Co., and contains 58 claims, of that early date. It covers a line switch and system in which the line switch is normally ready and selectively positioned to connect a line to a trunk whenever the subscriber lifts his receiver to operate the switch magnets.

1,317,597. Switch Mechanism. Issued to M. Setter, assignor to Automatic Electric Company, Chicago, Ill. (Application filed 1905.) An early application, just issued in patent form recently, upon mechanical details of the Strowger switch.

1,318,004. Callsender Circuit. Issued to B. D. Willis, assignor to Automatic Electric Company, Chicago, Ill. To make the signal relay more quickly responsive, the current through it is increased during the interval of sending signals by the expedient of shunting the line-loop feed relay through contacts of the slow relay at the first selector.

1,318,670. Selective Signal System Issued to Horace Hull, Denver, Colo. In a farm-line selective signal system, selection is made by a predetermined number of cycles of alternating current, and each telephone set is provided with a hand generator and an impulse counter which may be adjusted to the number of cycles desired.

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AN INCIDENT OF THE COAL STRIKE.

Boilers Went Cold and Trains Refused to Run When the Miners' Strike Stopped the Production of Coal Last Month, but the Telephone Went on Just the Same—Under Difficulties.

The average duration of a telephone conversation now is just twice as long as during the war, it developed at a hearing before the public service commission of New York. During the war the average telephonic conversation lasted two minutes, now it lasts four.

Independent Convention in Atlanta February 4 to 6

UNITED STATES INDEPENDENT TELEPHONE ASSOCIATION.

BECAUSE of the unusual conditions the telephone industry has been passing through during the years of the war, resulting in employees enilsting in military sericev by the thousand, the slowing down of all extensions and development work, the shortage of labor, the greatly increased cost of operation, the depreciated value of the dollar, the period of Govern ment control and the many pressing problems confronting member companies and the Independent telephone industry, it has been decided to hold a Winter Convention of the United States Independ ent Telephone Association at Atlanta Georgia, February 4th, 5th and 6th, 1920.

There are in the southern states a large number of Independent telephone companies who are not affiliated with either a national or state organiza tion and the best interest of the industry demands that the organization be more effective and complete.

Every company, regardless of size should be a member. Hence another reason for calling this National Convention at this time.

Atlanta, a city of 250,000 population, is the great industrial and distributing center of the South. The Piedmont Hotel will be the Convention headquarters, the entire ninth floor having been taken over by the Association for that purpose. Within a radius of two blocks of the hotel there are several other first-class hotels so that suitable reservations can be se cured for at least 1,000 telephone men; there will be room for several hundred at the Piedmont.

It is expected there will be a large attendance to this Convention from the northern states, as it will give many an opportunity, not only to attend a Convention which will be helpful in every way, but also to find recreation with it. They play golf the year round at Atlanta.

The Georgia Independent Telephone Association will be host to the United States Independent Telephone Association, and will hold a business session of this association on the afternoon of February 5th.

Suitable reservations can be secured by writing to R. L. Stewart, president of the Georgia Independent Telephone Association, 521 Candler Building, Atlanta, Georgia, or by writing the Hotel of your choice direct.

W. S. Vivian secretary-treasurer of the United States Independent Telephone Association, will have charge of the space for exhibits.

All Independent Telephone men are cordially invited to plan to attend this meeting.

Public Utility Commission News

Reports Concerning the Activities of State Authorities in the Telephone Field

Arkansas

THE Arkansas Corporation Commission made an order in the case of Southwestern Bell Telephone Company for an increase in rates, the petition having been filed September 23. The hearings on the petition were begun on November 3, and a very thorough investigation was made of investment, revenues and expenses.

Prior to the taking over of the lines by the federal government August 1, 1918, the company had increased its rates in 54 of its 96 exchanges in the state; when the postmaster general assumed control, the company was preparing to put in these increased rates in remaining exchanges, but this was deferred until May 1, 1919.

The testimony shows that the book cost of the company's property in Arkansas is $6,553,468, and that reproduction would cost them ten million dollars.

The commission finds that the company is earning, under existing rates, only 3.18 per cent on the actual cost of its property. The increase in revenue from January, 1917, to April, 1919, was 34 per cent while the operating expenses increased 70 per cent during the same period. The commission, in approving the present rates, charges rules and regulations as fixed by the postmaster general, says:

"It will not be understood that any individual community is precluded from applying to the commission for an adjustment of rates, and the jurisdiction of this case will be retained for the purpose of inquiring into the propriety of the rate in any particular exchange.

"No rate of return can be deemed reasonable which is not high enough to attract a normal flow of capital to this form of investment. The evidence shows that this company must have additional capital if its business is developed in conformity with the needs and progress of the state, and it cannot secure such additional capital unless it be permitted to earn a fair return upon the value of its present investment. We have arrived at this conclusion from a consideration of the company's revenues, investment and expenses in the state as a whole, and have not gone into the question of individual exchange rates. The uncontradicted evidence establishes beyond question that the rate structure as a whole does not produce an unreasonable return on the investment."

Florida

The state railroad commission denied applications of the Southern Bell Telephone Company and 34 independent telephone companies of the state for a continuation of the higher rates fixed by Postmaster General Burleson, during the period of government control. The commission also restored moving and installation charges to the pre-war status.

Illinois

The present charge for telephone toll service in effect in the plant of the Bureau County Independent Telephone Company comprises certain flat rate super-charges on an annual basis covering the right to obtain unticketed service between exchanges owned by the Bureau County Independent Telephone Company, and also flat rate super-changes on an annual basis covering the right to obtain unticketed service between exchanges owned and operated by the Bureau County Independent Telephone Company and other points where exchanges are owned and operated by other telephone utilities but reached over telephone circuits belonging wholly or in party to the Bureau County Independent Telephone Company. It is proposed to make certain flat increases in several of the rates between the points mentioned, the increase being based upon the mileage charge for toll service as authorized by the postmaster general.

In addition, the Bureau County Independent Telephone Company asks authority to discontinue the present practice of allowing its subscribers a discount of 50 per cent on all toll calls placed by such subscribers between exchanges owned wholly by the Bureau County Independent Telephone Company. The supercharge which it is proposed to discontinue is a so-called "County Right" rate of $6 per annum whereby subscribers at any of the exchanges of the Bureau County Independent Telephone Company can place an unlimited number of toll calls between points wholly owned by the Bureau County Independent Telephone Company for the annual super-charge of $6.

The commission having carefully considered the evidence finds that the present system of "county right" toll charges and also the privilege of a 50 per cent reduction in toll rates to subscribers on calls between exchanges of the Bureau County Independent Telephone Company results in a discrimination between its subscribers availing themselves of the "county right" and those subscribers who do not so avail themselves, and also between the entire body of subscribers of the Bureau County Independent Telephone Company and nonsubscribers, and that such discrimination must be discontinued.

The mileage basis on which the proposed flat rates are based is a just and reasonable method of computing toll rates and therefore should be followed by the Bureau County Independent Telephone Company.

The proposed toll charges between points reached by lines belonging to the Bureau County Independent Telephone Company, as specified, are just and reasonable, and should be approved.

The present telephone rates in Champaign and Urbana are to remain in force until the engineers of the public utilities commission can appraise the physical properties and audit the accounts of the Bell Company and if these rates are found too high, rebates will be made to subscribers. Service connection charges are to be suspended pending investigations.

An order was granted by the State Public Utilities Commission to the Farmers and Merchants Telephone Company, a corporation engaged in furnishing telephone service in Lovington, Illinois, placing in effect on January 1, 1920, a new schedule of rates, wherein each subscriber is charged an additional rental of twenty-five cents per station per month, with a discount of twenty-five cents per station per month if the bill is paid on or before the 15th day of the month in which the service is rendered.

The public utilities commission issued an order denying the application of the Chicago Telephone Company for permission to continue the use of the Burleson schedule of rates and continuing the present rates in effect, with the exception that an additional charge is allowed for a person to person toll.

Word has been received by the Macomb Telephone Company that an increase in service rates ranging from 15 to 25 per cent has been granted by the Public Utilities commission.

The approved rates is said to be the same as that agreed upon by the Macomb Commercial Association and the Macomb Telephone Company. The increased rate was judged to be fair in view of the rising costs of maintenance. The free exchange services which have prevailed will continue as heretofore.

Telephone rates for all but residences have been boosted from 25 cents to 50 cents in Quincy, and it will cost $3 to have a telephone moved in the future. The only thing which was not sent upward by the commission was the installation of telephones. The company had asked for this, too, but the commission decided that it would not be right.

The largest increase is on business telephones, which are jumped from $4 to $4.50, and on the two-party lines from $3.50 to $3.75. County line telephones are increased from $1.50 to $1.75. Hotels are hit hardest. All calls outside of the hotel are now 10 cents, and the hotel is deprived of its former commission on business.

The proposed increased rates for telephone service in Leaf River, Ogle county, were suspended until May 11, 1920, pending an investigation by the commission as to the reasonableness of them.

The commission for the same reason suspended until April 12, 1920, the proposed increased rates in Belvidere of the Belvidere Telephone Company.

Indiana

Permission to issue stocks and bonds sufficient to finance its proposed purchase of the Central Union Telephone Company's system and business in Terre Haute on the basis of an agreed or appraised valuation of $834,649 is requested in a petition the Citizens Independent Telephone Company, of Terre Haute, has filed with the public service commission.

The company would issue $192,000 capital stock; $379,400 of 5 per cent first mortgage bonds at an amortized value of 92 per cent of par in payment of $349,048 of the purchase price and $1,320,000 of 6 per cent refunding and extension bonds.

The company would tender as part payment the capital stock, the 5 per cent mortgage bonds and $240,000 of the 6 per cent refunding bonds. It would use $80,000 of the refunding bonds to finance the expense of unifying the systems and $1,000,000 of the refunding bonds to refund an old first and refunding issue bearing 5 per cent interest.

The company avers in its petition that it has property worth $1,100,000, supplying service to 8,252 stations and that the Central Union has property worth $850,000, supplying service to 5 449 stations, and that the consolidated company would need an annual revenue of $500,000 and would serve with a single system 12,478 stations.

Authority to organize a new telephone company to purchase eight telephone companies in southern Indiana is asked in a petition filed with the commission. The new company is to be known as the Southern Indiana Telephone and Telegraph Company and is being organized by L. C. Griffiths, J. H. Andrews, J. W. Richart and I. B. Thompson of Seymour and H. H. Carter of Scottsburg. The company asks authority to issue $300,000 common stock in order to purchase the merging companies. Authorization of $200,000 7 per cent preferred stock to be issued from time to time to buy other plants and to make additions and betterments and permission to issue $45,000 7 per cent short term notes to take up outstanding obligations of the consolidated companies and to provide additional working capital are asked. The companies in the consolidation are the Seymour Mutual Telephone Company, Home Telephone Company of Brownstown, Home Telephone Company of Bicknell, Jennings County Telephone Company, Scott County Telephone Company, North Vernon and Vernon Telephone Company, Butlerville Telephone Company and Lexington and Little York Telephone Company.

The public service commission granted the petition for the merger of the Ossian and Uniondale Telephone Companies.

The merger is more in the nature of a purchase by the Uniondale Rural Telephone Company, of the Home Telephone Company of Ossian from Elias H. Roe, and the deal involves approximately $2,000.

The Uniondale company, at the present time, has more than 625 subscribers and the Ossian Company had about 100 subscribers.

Henceforth the company will operate under the name of the Uniondale Company.

Telephone rates in Lafayette will be increased January 1, the commission having decided to grant the Lafayette Telephone Company's petition. Single business telephones will cost $3.50 a month and single line residence telephones will cost $2 a month. The present rates are $2.50 for business and $1.50 for residence. Rural single line subscribers must pay the same new rate as city subscribers plus a line charge of 50 cents per quarter mile beyond the city limits. Purdue university must pay $3 a month instead of $2 a month for its telephones and the city schools must pay $3 a month instead of $1.67. Four-party line residence subscribers will pay $1.50 a month instead of $1 and ten-party rural line telephones will cost $1.75 a month instead of $1.50.

The commission expresses the belief that the new schedule of rates will give the telephone company approximately the revenue which is deemed necessary to meet the company's increased expense budget. The new rates are substantially those for which the company petitioned, the city's contention that the petition be disallowed having been set aside.

The telephone company is ordered to set aside annually for depreciation 5 per cent of the value of its depreciable property, and to pay into a depreciation fund, the moneys provided for depreciation, this moneys to be properly invested in 4 per cent securities, thus accumulating a reserve from which the company may borrow to obtain money for new construction and additions. The commission found the property of the telephone company to be valued at $550,000.

The new schedule for rates allowed follows:

Business P. B. X., trunk lines, when equipment is owned by subscriber, $5.

Business P. B. X., trunk line, when equipment is furnished by company, $3.50.

P. B. X. board, $1.

P. B. X., switches, (minimum of four stations each), $1.

Cost of installation of P. B. X. equipment to be paid by subscriber when such equipment is taken on less than three-year contract.

Single line business, $3.50.

Purdue university, $3.

City schools, $3.

Single line residence, $2.

Four-party residence, wall, harmonic, $1.50.

Rural party telephone, not exceeding ten parties to line, $1.75.

Extension telephone, business, $1.

Extension, residence, 75c.

Extension bells within 100 feet of instrument, 25c.

Extra listing in directory, business, 50c.

Extra listing in directory, residence (in same family), 25c.

To the above base rates for individual business and residence telephones, there shall be added a line charge of 50c per month for each one-quarter of a mile of line or fraction thereof beyond the city limits.

Orders continuing in effect from December 1, until further notice, the telephone rates put into effect by the federal government and legalized up to December 1, 1919, by the congress in legislation providing for the return of wire systems to private control, were issued by the Indiana public service commission.

The return of the telephones involves review of the major part of all telephone rates, tolls and charges in the state of Indiana. Contrary to methods adopted by many commissioners the Indiana commission adopting the plan of holding separate hearings in each town or city in which change of rates has been made so that all having interest could be heard.

The Public Service Commission authorized the People's Mutual Telephone Company of Silver Lake to purchase the Claypool telephone exchange from E. Braude, for a consideration of $12,000 common stock in the Mutual company, and authorized the Silver Lake company to increase its capital stock from $30.000 to $50,000. The Uniondale Rural Telephone Company of Uniondale was authorized to purchase the Home Telephone Company of Ossian from Elias R. Roe.

The municipal plant of Goshen petitioned the Public Service Commission yesterday for increased water rates for meter service and the establishment of service charges for all meter consumers. The primary meter rate asked is 13 cents a hundred cubic feet for the first 6,000 cubic feet used monthly. The schedule is graduated to 7 cents a hundred for more than 60,000 feet a month. The primary annual service charge asked, which would affect most domestic and small consumers, is $3.50. The Winona Telephone Company asked authority to issue $30,000 preferred stock to reimburse the treasury for expenditures made.

The Seymour Mutual Telephone Company's schedule approved by the commission provides for a slight reduction in the rates now in effect, but gives the company an increase over the rates effective prior to July 1.

The commission orders that the telephone company refund to its patrons all sums collected in excess of the rates legally in force at the time of the filing of this petition, that is the Burleson schedule.

The new rates authorized by the commission are as follows:

	Gross	Net
Single line business	$3.00	$2.75*
Party line business	2.50	2.25
Single line residence	1.90	1.65*
Two-party line residence	1.65	1.40
Four-party line residence	1.50	1.25
Ruray party line residence	1.75	1.50
Rural lines owned by farmers		.75
Switching service to farmers' exchanges		
Extension bells		
Extension telephone		.50

*Plus an additional charge of $.25 per month for each quarter mile or fraction thereof, beyond the corporate limits of the city of Seymour.

The net rate shall be charged if bills are paid within ten days.

The Greenfield Telephone Company is authorized to issue and sell at not less than par, 250 shares of preferred stock of the par value of $100 each, which shall bear semi-annual cumulative dividends at the rate of 7 per cent per annum, and which shall be redeemable at the rate of $2,000 each year beginning three years after date of issue and the proceeds received from the sale of said stock to be used exclusively for betterments and extensions.

In an order issued by the commission the Claypool Telephone Company is given authority to raise its rates. Hearing on the company's petition for an increase in rates was held in Warsaw November 10. The order provides, however, that the telephone company shall pay a rental of ten cents per month to all subscribers owning their instruments.

Authorization for an advance in the telephone rates of the Syracuse Home Telephone Company has been allowed by the commission. The following rates have been authorized:

	Gross	Net
Single line business	$1.90	$1.75
Single line residence	1.65	1.50
Party line business	1.65	1.50
Party line residence	1.40	1.25
Party line rural	1.40	1.25

For rural single and two party line service, the rate shall be the above town rates plus an additional charge per month of $.50, for each mile or fraction thereof, beyond the corporate limits of the town of Syracuse.

The net rates shall be charged if bills are not paid on or before the 15th day of the month in which service is rendered; otherwise the gross rates shall be charged.

The Crown Point Telephone Company, which in December, 1918, was denied a raise in rates, and which was recently given a rehearing by the Public Service Commission, was granted the concessions asked in its petition. The rates of the company are raised from $24.00 to $36.00 for business telephones and from $18.00 to $24.00 for single line residence telephones. Party lines were also advanced correspondingly.

Following is the new schedule:

	Business	Residence
Single line	$36.00	$24.00
Two-party line	30.00	21.00
Four-party line	24.00	18.00
Eight-party line rural (maximum eight stations)	24.00	18.00
Extra mileage beyond city limits, per quarter mile or fraction thereof, single line	6.00	6.00
Two or four-party line	3.00	3.00
Extension telephones (within buildings)	9.00	6.00
Extension bells	3.00	3.00
Switching charge, where party owns and maintains line to city limits	12.00	12.00
Private branch exchange:		
Switchboard	36.00	.....
Trunk lines	36.00	.....
Terminals	9.00	.....

The commission orders residence rates in Decatur increased twenty-five cents while the rural rates has been slightly lowered. The commissioners have ordered the telephone company to enforce the new rate on and after January 1. The rate is as follows:

	Gross	Net
Single line business and professional	$2.15	$2.00
Single line residence	1.40	1.25
Four-party line residence, within the corporation limits of Decatur and Berne	1.25	1.10
Party line, rural	1.40	1.25
Extension Telephone	.50	.50
Extension bells	.50	.50

It is ordered that the net rate is to be charged if bills are paid before the tenth of each month, and the gross rate charged if bills are paid after the tenth.

Clifford Robbins, manager of the Farmers' Telephone Company of Muncie, has been officially notified by the public service commission that the company has been granted an increase in rates. The new rate will be $1.50 per month, if paid on or before the fifteenth of the month, and after that date the rate will be $1.60.

Kansas

The present telephone rates, which the Southwestern Bell Telephone Company and other companies in the state are urging the state public utilities commission to make permanent, were labeled the "labor rates" rather than the "Burleson rates," by J. W. Gleed, of Topeka, general attorney for the company, testifying before the utilities commission.

"In substance," said Attorney Gleed, "this proceedings is for the purpose of adjusting rates to the new necessities of labor. It is true that the largest increases in the pay-rolls and expenses occurred during the past year, but it is not fair to attribute these increases to the government possession of the lines. The increase in the pay-roll became necessary by reason of the increased cost of living."

Michigan

At a meeting of Independent telephone men of Hillsdale county resolutions were adopted unanimously which will be presented to the Michigan Utilities Commission as expressive of the sentiment of the county. It was decided by the resolutions committee, and by the president, M. G. Mosher, in whose hands they were placed, that the resolutions should not be published, as this would give information to representatives of independent companies who might wish to fight the action taken by the men at the meeting.

However, the resolutions were intended to ask the state commission to give an explanation of their recent ruling, in regard to discontinuance of free service between telephone exchanges, and to state definitely if it was the intention of the state commission to have this ruling apply to independent companies; also, in case, such was the intention of the state, it is desired to have the ruling set aside as applying to the independent companies.

The telephone men say that they have had no direct word from the state commission that the ruling was to include them.

The following committee was appointed to meet with the Hillsdale Chamber of Commerce and see if there was an opportunity of getting free service into Hillsdale: Walter W. Buell, Litchfield; Ralph Robins, Mosherville; William Ossius, Hillsdale; John Williams, North Adams.

A motion was made and carried that meetings be held once each year, in Hillsdale. Another motion was carried that the officers of the meeting. M. G. Mosher of Osseo, president, and Byron Ables, Reading, secretary, hold over for the year and call the next meeting.

Relief from the temporary schedule fixed in August by the public utilities commission, as sought by the company, may reopen the whole controversy over telephone rates in Michigan, it is declared. Municipalities bitterly fought the proposed higher schedules asked by the company and some of them were none too well satisfied with the temporary schedule finally agreed upon.

The Michigan State company is asking the adoption of no definitely named schedule, but proposes that the state assign accountants to verify its figures, on the basis of which relief is demanded.

The telephone company also informed the state commission that the parent corporation had authorized the expenditure of $12,000,000 for the immediate betterment and extension of telephone service in the state. While no definite statement was made, W. W. Potter, member of the commission handling telephone matters, and with whom the company's representatives conferred, believes part of the money will be used for installation of automatic telephones in Detroit, an improvement promised some months ago. This is also to be used to give service in Detroit and Flint, particularly to persons who have been unable to get service. The statement shows the following to have been paid by months under the contract to the A. T. & T. in Michigan and Detroit.

	State	Detroit
July	$32,928.28	$18,525.16
August	44,043.85	21,205.72
September	43,670.52	21,662.74
October	34,175.43	20,622.45

Also on the statement are shown the company's operating revenues and expenses for the same four months. For each of the 30-day periods, receipts were according to the statement.

	State	Detroit
July	$1,144,028.77	$515,734.11
August	1,016,049.45	489,195.66
September	1,007,575.00	499,738.71
October	1,052,072.49	521,462.88

Operating expenses including payments to the A. T. & T. for the same periods follow as taken from the report:

	State	Detroit
July	$927,147.27	$469,246.72
August	755,160.28	404,342.51
September	777,176.61	392,920.15
October	862,625.46	451,559.44

Increase in telephone rates have been granted by the Michigan Public Utilities Commission to the Walled Lake Home Telephone Company in Oakland county and the Farmers' Telephone Company of Dundee and Azalia, in Monroe county.

The former is to be paid $15 a year for all party-line service but is limited to 10 subscribers to a line.

For the larger company rates will be as follows:

One-party business telephones per year, $27; two-party business, $24; one-party residence, $18; party-line residence service, not more than four to a line, $18; farmers' telephones, $18; extensions, $6.

Three thousand telephone subscribers of Hillsdale county are affected by order of the Michigan Public Utilities Commission, eliminating all free conversation between different exchanges. The order does not affect the Michigan State Telephone Company, which discontinued all free service several months ago, but it does affect the following Hillsdale

County Companies: Hillsdale County, Reading Central, Camden Rural, Cambrai Rural, Fayette Telephone, North Adams, Moscow Telephone, Jerome Telephone, Somerset Center, Waldron Telephone and Rollin Telephone Company. The Hillsdale County Telephone Company, at the present time, is giving free service to about 20 different exchanges in the county. The Reading Telephone Company is now giving free services to five exchanges. Each company is giving free service to a few places. But under the order just issued by the state commission, all of this free service must be discontinued. .

Reasonable and adequate service must be given by the Thum Telephone Company at Applegate and Port Sanilac if increased rates granted in the order are maintained, it is provided in an order of the Michigan Public Utilities Commission.

The commission's order expressly states that commission reserves the right to reduce rates if the company, fails, neglects or refuses to give such service.

Similar provisions are contained in an order granting increases to the Shiawassee and Genesee Mutual Telephone Company. These advanced rates are $24 a year for one-party business telephones, $18 for two-party business, $18 for one-party residence and $15 for two-party residence service.

Missouri

The public service commission denied the petition of the Missouri Telephone Association and the Kinloch Telephone Company of St. Louis, in which they asked for a modification of the ruling recently made by the commission eliminating the installation and removal charges of $3.50 and $1.50. These charges were allowed by Postmaster General Burleson while the wires were under government control.

Reductions estimated at $209,194 a year in telephone charges were made by the public service commission on the application of the Southwestern Bell Telephone Company, and other telephone companies and the Western Union Telegraph Company for authority to continue for an indefinite period the rates granted by Postmaster General Burleson.

The long distance telephone rates established by Burleson are not disturbed. They will continue for a period of thirteen months from December first.

Fifty per cent of the increase allowed the Western Union Telegraph Company by the postmaster general is eliminated. The increase granted by the postmaster general was estimated at 20 per cent and this is cut in half for a period of thirteen months from December first.

Two charges allowed the telephone companies for installation and changing names of subscribers, the first being $3.50 and the latter $1, are eliminated entirely by the commission from and after December 1. Forty-three city exchanges will be affected by the ruling of the commission, of these forty-three are Bell exchanges. The change in the St. Louis rates relate to straight business telephones. These rates are reduced from $9 to $8.50 a month by the finding of the commission. The commission estimates that this will amount annually to $31,818.

The list of city exchanges affected by the order of the commission follows: Armstrong, Benton, Bismark, Bloomfield, Blue Ridge, Brookfield, Campbell, Carrollton, Clarkton, Clayton, Dexter, East Prairie, Essex, Eureka, Fayette, Glasgow, Grain Valley, Hayti, Hannibal, Lees Summitt, Lilbourne, Marshall Moberly, Noel, Oran, Poplar Bluff, St. Clair, St. Joseph, Sedalia, Senath, Sikeston, Smithville, Southwest City, Springfield, Stanberry, Trenton, Washburn, Webster Groves, Wentworth. The commission estimates that the exchange rate reductions to these cities will amount to $91,194 a year.

New York

When the ban was lifted after the armistice was signed the New York Telephone Company was nearly two years behind in its plant expansion program, its working force was depleted, and it was face to face with an increase demand for service, over and above the abnormal war-time traffic.

The above facts were brought out at a public hearing in the Hall of Records, Manhattan, before the up-State Public Service Commission, Thomas F. Fennell presiding, and New York City's telephone service was gone into thoroughly.

In the year closing the company has completed or started work on telephone plant and property in Greater New York to the value of $11,400,000. It has opened three new central offices and established five new central office districts. It has increased its operating force since January 1 last by a total of 1,481 operators in Manhattan and the Bronx alone.

It has installed 168,000 new telephone stations—50,000 more than in 1918. And it has handled with gradually proving ability a daily traffic that through the year has averaged 10 per cent greater than in 1918, when the traffic was heavily abnormal. The daily originating traffic in Greater New York in November, 1919, averaging 1,000,000 more calls than in November of last year.

At the present time the company is constructing six large central office buildings and a number of large additions to existing buildings, representing a cost of $4,686,000. Its building program for next year provides for completing the work now under way and, in addition, starting six new buildings and additions to three new buildings in Manhattan and the Bronx, this program calling for an expenditure of between $8,000,000 and $9,000,000.

The heavy increase in the demand for service that began almost as soon as the war ended has had the effect of nearly quadrupling the company's estimates of line growth for the year on which is now at work. In addition to the increased demand for lines and stations and a heavy increase in the number of calls per station, there has been a 25 per cent increase in the average length of telephone conversations. This has a very appreciable effect upon the effort to render quick service.

Ohio

A bill, fostered by Representative Robinson of Hancock County, is now in the Senate Public Utilities Committee. It provides that telephone companies cannot change their rates until given permission by the State Utilities Commission.

The State Public Utilities Commission has notified the city of Fremont and the Fremont Home Telephone Company that the latter cannot put into effect its schedule for increased telephone rates until after the complete consolidation of the Home and Bell plants and the combined plant is in perfect running order.

The state public utilities commission issued a blanket order prohibiting telephone companies operating in Ohio to increase their rates above those fixed by Postmaster Burleson

and which went out of effect on December 1.

The commission declared an emergency exists and that the government rates "have not been in effect a sufficient length of time to determine whether they will yield more or less than a fair return upon the investment in these uncertain times."

The Burleson rates are considered by the commission as the maximum that may be charged and those companies which did not get boosts under government control may not boost their rates at present.

The commission ordered the Middleport and Pomeroy Telephone Company to desist in its effort to collect an increase in telephone rates of $1 a month.

Merger of the Hamilton Home Telephone Company with the Cincinnati & Suburban Telephone Company was formally authorized by the Public Utilities Commission of Ohio following authorization by the United States Department of Justice.

The Bell Company operates the combined properties commencing December 1.

Unification of the two plants will be effected after January 1. New directories are being printed.

Free telephone service to Darrtown and Oxford will be discontinued, and the rates now being charged Bell Company subscribers will be in effect, that is, Hamilton-Darrtown 10 cents; Hamilton-Oxford, 15 cents.

That higher telephone rates asked for by the Chesapeake and Potomac Telephone company are unjustified at this time and that the rates now in effect have not been sufficiently tested to determine by actual experience whether they are inadequate, is the opinion of the Ohio commission.

In its written decision, the state utilities commission ordered that the existing exchange rates for service of the Chesapeake and Potomac Telephone Company shall be continued for a period of one year from the date they become effective, or until June 16, 1920. At the expiration of the one-year period the telephone company will be required to render an account of its receipts, expenditures and other data for the further consideration of the public utilities commission.

Pre-war rates on telephone service in Cincinnati have been re-established by a decision of the state public service commission. Rates on domestic service have been reduced to the old figure.

Oklahoma

All report charges connected with long-distance calls, and the installation charges, as provided in the order of Postmaster General Burleson when the government took charge of telephone lines, are abolished in a temporary order issue by the corporation commission, which will remain in effect pending termination of hearing before the commission of case of the Southwestern Bell Telephone Company, having to do with service and rates.

The removal charge of $1.50, under the Burleson order, will stand for the present. The commission's old rates on short mileage long-distance calls will be reinstated. This will slightly increase some of these particular rates but affects only the short mileage calls and some of the smaller lines. Other exchange and long-distance rates as promulgated in the Burleson order remain in the temporary order of the commission.

Upon the application of attorneys for the company the corporation commission postponed until February 20 the resumption of the hearing on the several thousand complaints filed against the service being rendered in Oklahoma by the Southwestern Bell Telephone Company.

This means that no official action will be taken by the commission looking toward improvement in service or re-adjustment of war time rates, which are now in effect for the next two months.

This is the fourth postponement of the hearing, granted in each case on the application of the telephone company.

Oregon

The Burleson-made telephone rates were declared illegal by the State Public Service Commission and substitute rates materially reducing those fixed by the Postmaster-General, are ordered into effect. This order affects the Pacific Telephone and Telegraph Company, and all its subsidiary concerns.

Pennsylvania

The public service commission in refusing to grant the Bell Telephone Company of Pennsylvania the right to continue the Burleson war-time telephone rates, directed the company to reinstate, beginning December 1, the rates approved by the commission in April 1917. The decision means more to the company in loss of revenues than the order of two years and a half ago when the commission directed the tariff schedules to be based on a general reduction of $1,000,000 in the company's revenues.

The federal control rates jumped the revenues up to $426,000 from May, 1919, the month prior to the effective date of the increase, to July, the first full month under the new collection. The total telephone revenue of the company in May was $1,970,017 and in July it was $2,400,613. The August revenues amounted to $2,284,202 and in September they were $2,303,740, while in October they totaled $2,445,041. The May revenues were higher than any of the prior months of the year.

The Burleson toll rates were effective January 21 last, but because of the state's injunction suit it was June 11 before they become actually effective, and it was June 16 when the 20 per cent increase was made in the rental rates. The installation service charges date back to September 1, 1919. Those are wiped out by the decision, as are also the special classifications on toll charges.

The 1917 rates, which again go into effect, will be approximately 20 per cent lower than those charged since last June. The older rates will now have to stand until next April, at least. Then the three-year period for which the 1917 rates were fixed will have expired and the company can go before the commission.

South Carolina

After an all day conference of members of the railroad commission and representatives of the Southern Bell Telephone Company, the Columbia chamber of commerce and other business interests, it was agreed that the present rates for local and long distance service in South Carolina should be continued as test rates for a test period, subject to review at any time upon the order of the commission.

Virginia

Following a hearing before the state corporation commission physical connection between the lines of the Roanoke and Botetourt Telephone Company and the Chesapeake and Potomac Telephone Company has been ordered. Under the old system residents in Botetort county, although only a few miles out from Roanoke, could not communicate with that city by telephone. The new order will at once correct this condition.

A victory was scored by the Chesapeake and Potomac Telephone Company of Virginia before the state supreme court, when the court refused to grant a writ of mandamus sought by the city of Richmond to compel the company to render service at prewar rates, which the city claims were irrevocably fixed by the franchise. The court holds that until December 1 the rate fixed by Postmaster-General Burleson are to be in effect, under and by virtue of an act of congress passed July 11, 1910, restoring telephone properties to their owners. Also that the state corporation commission has jurisdiction to prescribe what rates the company shall charge in Richmond after December 1.

West Virginia

The telephone rates now in vogue in Charleston will continue for the next six months at least.

Order was issued by the public service commission continuing in effect after November 30, the present rates of the Chesapeake and Potomac Telephone Company of West Virgina which were allowed when the company was under federal control. The rates would otherwise expire effective December 1.

The order cites that the recent hearing in regard to application to increased rates brought out evidence that the company was making less than two per cent—1.58 per cent being the exact figures—upon its capital invested.

The commission ruled that appraisal of the company's property and examination of its books would be made before decision is reached regarding the rate application. This work will consume about six months according to the estimate and in the meantime the rates will continue the same in this state.

Minnesota

The rates, charges, and classifications of telephone service as ordered by the postmaster general, and filed with the commission, on the 18th day of June, 1919, by the Northwestern Telephone Exchange Company, are approved as the existing and temporary rates from the date of such filing, subject to change by the commission as operating conditions may warrant and the Northwestern Telephone Exchange Company shall file with the commission, monthly, a complete statement of the operating revenues and expenses of said company, on such forms as the commission shall from time to time prescribe.

The present order deals only with the advisability of continuing the present rates pending the present investigation, until such a time as the commission finally determines what are reasonable rates, which involve not only the revenues and expenses for the company as a whole, but individual exchange rates, toll rates, including the question of the present classified toll rates ordered by Mr. Burleson.

It is ordered, that a hearing be held at the office of the commission on the 20th day of January, 1920, at 10 a. m., for consideration of all matters pertaining to the valuation of the property of the company used in furnishing facilities for toll service to the public within the state; to consider all items of expense and revenue of the toll service and all other matters pertaining to toll telephone service within the state.

The rates, charges and classifications of telephone service as ordered by the postmaster general, and filed with the commission on the 17th day of June, 1919, by the Tri-State Telephone & Telegraph Company, are approved as the existing and temporary rates from the date of such filing, subject to change by the commission as operating conditions may warrant and that the Tri-State Telephone and Telegraph Company shall file with this commission monthly a complete statement of the operating revenues and expenses of said company, on such form as the commission shall from time to time prescribe.

The present order deals only with the advisability of continuing the present rates pending the present investigation, until such time as the commission finally determines what are reasonable rates, which involves, not only the revenues and expenses for the company as a whole, but individual exchange rates and toll rates, including the question of the present classified toll rates ordered by Mr. Burleson.

It is ordered, that a hearing be held at the office of the commission on the 13th day of January, 1920, at 10 a. m., for consideration of all matters pertaining to the valuation of the property of the company used in furnishing facilities for toll service to the public within the state, and to consider all items of expense and revenue of the toll service and all other matters pertaining to toll telephone service within the state.

The Farmers Mutual Telephone Company of Goodhue County permitted to establish and place in effect, as of January 1, 1920, the following schedule of local and rural rates at Wanamingo, Minnesota:

Individual Line Business.....$2.00 per month gross
Two-party Line Business.....$1.75 per month gross
Individual Line Residence.....$1.75 per month gross
Two-party Line Residence.....$1.50 per month gross
Rural Multi-party (company owned).....$1.50 per month gross
Rural Multi-party, switching charge.....$0.35 per month net

A discount of 25 cents per month to be allowed on all gross rates if bill is paid monthly in advance.

It is ordered, that the application of the Bellingham Telephone Company for cancellation of its indeterminate permit in the village of Nassau and the discontinuance of telephone service be denied.

The South Dakota Rural Telephone Company is permitted to place in effect, as of January 1, 1920, the following schedule of local and rural rates at Jasper and Hardwick, Minnesota:

Individual Line Business.....$2.75 per month gross
Two-party Line Business.....$2.25 per month gross
Individual Line Residence.....$1.75 per month gross
Four-party Line Residence.....$1.50 per month gross
Rural Multi-party (exclusive business) metallic lines.....$2.25 per month gross
Rural Multi-party, Residence.....$1.50 per month gross
Rural Switching.....$4.20 per year net

A discount of 25 cents per month to be allowed on all gross rates if

bill is paid on or before the last day of the month in which the service is rendered, except that rural multi-party (company owned) are payable quarterly in advance, with a discount of 75 cents if paid on or before the last day of the first months of the quarter, 50 cents if paid on or before the last day of the second month of the quarter and 25 cents if paid on or before the last day of the third month of the quarter.

The Lyle Telephone Company is permitted to place in effect, as of January 1, 1920, the following schedule of rates for local and rural telephone service at Lyle, Minnesota:

Individual Line Business.....
.....$2.25 per month gross
Individual Line Residence.....
.....$1.50 per month gross
Rural Multi-party (company owned)
.....$1.50 per month gross

A discount of 25 cents per month to be allowed on all gross rates if bill is paid on or before the last day of the month in which the service is rendered.

The Le Sauk Rural Telephone Company is permitted to establish and place in effect, as of January 1, 1920, the following rate for rural service at St. Cloud, Minnesota:

Rural Multi-party, $1.75 per month gross to be billed quarterly in advance.

A discount of 75 cents to be allowed if bill is paid during the first month of the quarter; 50 cents if paid during the second month of the quarter, and 25 cents if paid during the third month of the quarter, in which the service is rendered.

The Tri-State Telephone and Telegraph Company is permitted to purchase from E. W. Randall, C. B. Randall and F. E. Randall all of the outstanding capital stock of the Rochester Telephone Company.

The St. Augusta Rural Telephone Company is permitted to establish and place in effect, as of January 1, 1920, the following rates for rural service at St. Cloud, Minnesota:

Rural Multi-party, $1.75 per month gross (to be billed quarterly in advance).

A discount of 75 cents to be allowed if bill is paid during the first month of the quarter; 50 cents if paid during the second month of the quarter, and 25 cents if paid during the third month of the quarter.

The Luxemburg Rural Telephone Company is permitted to establish and place in effect, as of January 1, 1920, the following rates for rural service at St. Cloud, Minnesota:

Rural multi-party, $1.75 per month gross to be billed quarterly in advance.

A discount of 75 cents to be allowed if bill is paid during the first month of the quarter; 50 cents if paid during the second month of the quarter and 25 cents if paid during the third month of the quarter.

Illinois Association Honors Retiring President

Ed. D. Glandon, of Pittsfield, retiring president of the Illinois Independent Telephone Association, was highly honored by that organization at its recent convention.

The convention unanimously adopted a resolution thanking Mr. Glandon for his services and calling attention of the association's membership to its success during his presidency.

Mr. Glandon retires after four years as the organization's head. During his presidency the association passed through a critical period which followed its organization and it now is firmly established.

When Mr. Glandon took charge of the affairs of the association four years ago, it was in bad shape generally. Its membership was low and those remaining had lost interest. Through Mr. Glandon's careful, business-like management of its affairs, the association has become an integral factor of business in this state. Two hundred new members were added to the membership roster and interest in the affairs of the association is very high.

At its recent meeting the association agreed that a 300 per cent increase in dues would be assessed if necessary to continue the work in the manner it was handled by Mr. Glandon. A paid secretary is to be employed to do the work which President Glandon handled practically gratis.

Glandon simply demonstrated what could be done through and by the association. The association has unanimously agreed that the success of his efforts more than warrants their continuance.

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EX-SERVICE MEN AS FIRE OPERATORS.
King George's scheme for the employment of disabled ex-service men has been adopted by many firms throughout England, the Tottenham Fire Brigade being one of the first to employ disabled ex-service men in its watchrooms. The photo shows Ex-Private P. Daines, who has lost his right arm and now serves as telephone operator at Tottenham Fire Station.

To Spend Twenty Million in New York City

The increase in the number of telephone calls in New York since the signing of the armistice has been unprecedented and the company is carrying on a construction program that will involve the expenditure of $20,000,000 within the city during the coming year. This expenditure will provide the equipment necessary to catch up with the requirement of traffic.

Pay Station In Wilderness Saves Hunters' Lives

An isolated telephone pay station is located at a camp on the shore of Richardson lake, one of the Rangeley group in northern Maine. This telephone is more than 30 miles from the nearest station at Rumford, on the Maine Central Railroad. The line runs 12 miles from the camp to the town of Andover, where connection is made with switchboard in the office of the Andover Telephone Company, a sub-licensee of the New England Company. From that town the lines extend 18 miles to Rumford. From this telephone many emergency calls have originated during the ten years since the station was established. It has been the means of saving the lives of many hunters and woodsmen who have been injured in the north woods.

Of Interest to the Trade

What the Telephone and Accessory Manufacturers are Doing to Advance the Art

An Automatic Exchange for Halifax.

The telephone users of Canada are by no means unfamiliar with automatic service, which has been in operation for twelve or fifteen years in the central provinces, and now is found installed or under construction in 14 cities throughout Alberta, Manitoba and Saskatchewan.

With the placing of an order for automatic equipment by the Maritime Telephone and Telegraph Company, Ltd., for its Lorne office on the Halifax system, a fourth province, Nova Scotia, will become acquainted with the dial.

The Maritime Telephone and Telegraph Company operates a total of about 27,000 stations, covering practically the entire province with its largest exchange in Halifax, the capital city, where close to 10,000 telephones are in service.

The Halifax system consists of three offices: Sackville, covering the principal business section of the city; Harbor, serving the community across the bay from the city, and is connected by submarine cables, and Lorne, in the residential section, where approximately 30 per cent of the stations terminate. The company's program calls for the immediate installation of 2,800 lines of central office equipment in a new fireproof building being erected to house the Lorne office. This is to be followed later by the conversion of the Sackville and Harbor offices, making the entire network automatic in every respect.

The Maritime Company's decision to adopt automatic equipment was prompted by the same causes as have been found in so many other places. Difficulty of maintaining proper service, securing and retaining sufficient operators, and holding operating costs at a figure which will permit of a proper return on the capital invested at rates which the subscribers will regard as reasonable. J. H. Winfield, general manager of the company, after a very careful study of the situation, decided that automatic equipment offered the only adequate solution to the problems the company was facing, and A. J. Barnes, equipment engineer, in conjunction with Automatic Electric Company's engineers, has worked out the detailed program which will give effect to the general policy then laid down.

The equipment covered by the contract will consist of 29 units; one for P. B. X. service, (automatically selecting an idle one of a number of trunks to a subscriber), one for pay-stations, eight for individual lines (message rate), six for two-party lines (flat rate), six for four-party lines (flat rate), and one for 10-party rural service.

Each rural line will terminate on a first-selector repeater, and the signaling will be by means of codes rung automatically upon dialing the number of the party wanted. The rural lines will be equipped with telephones having dials, giving them full automatic service, and will have hook-switch latches, so that the subscriber may listen in to be certain that the line is not in use before beginning to dial.

The pay station lines will be of the automatic pre-payment type, with telephones of the Gray three-coin-slot, prepayment, pay-station type. For local automatic service, it will be necessary to deposit a coin before dialing, which will be automatically refunded when the calling party hangs up on such calls as "don't answer," "busy," information, complaint and calls to the various departments of the telephone company.

Lorne subscribers desiring long-distance connections will dial the digit "9" and then select recording trunks terminating on the recording positions of the long distance switchboard in the Sackville exchange. The toll recording trunks will be equipped for discriminating tone-test service. By dialing "1004" a subscriber desiring a suburban number (local toll) will reach an operator who will give "express" service on such calls. These trunks will also be equipped with discriminating tone tests.

Toll calls to Lorne subscribers will be handled by the regular long distance operators at the toll switchboard in the Sackville office. Their positions are to be equipped with dials and trunks leading to incoming toll second selector switches in the Lorne exchange. The long distance operators will omit the first digit of the Lorne subscribers, when dialing.

A four-position combination test, complaint, dead number, emergency and operator service desk is to be installed in the Lorne exchange, but information calls will be handled over special trunks going to the existing information desk located in the Sackville exchange.

No special features characterize the power, main frame and other equipment called for, and the whole installation is so designed that when subsequent steps are taken toward making the Halifax area full automatic, no existing equipment will have to be displaced or modified to make the entire system a unified and co-ordinated whole.

Newly Equipped Plant at Alton, Ill.

From a small magneto exchange serving 344 subscribers 15 years ago to a modern system serving some 2,500 patrons, with new common battery equipment, housed in an up-to-date exchange building, is the history in brief of the Alton, Ill. exchange of the Kinloch Long Distance Telephone Company, which has its headquarters in St. Louis, Mo.

T. W. Atchison, the present local manager at Alton, who was solicitor and collector at the time the company commenced operations in that city, states that the competing Bell exchange was then operating about 1,200 instruments, whereas now the Independent company has over 500 subscribers more than its competitor.

The two-story exchange building which houses the new Kellogg equipment recently installed, is well laid out and the rooms are large and airy. The structure occupies a prominent location on a hillside overlooking the main part of Alton. The offices are located on the first floor adjoining the entrance. The power room, warehouse, battery room and garage are also located on the first floor. The switchboard room, terminal room, and operators' restroom are on the second floor.

The switchboard consists of four steel frame sections, the wood-work being of solid mahogany. Each section is constructed for three operators' positions and nine panels.

Fourteen hundred common-battery line circuits are wired and equipped, arranged throughout the four sections on a six-panel multiple basis, line lamps being associated direct with the multiple jacks located in front of local positions 5 to 10 inclusive. Consequently, each subscriber, when calling the central office, can be answered by any idle local operator.

Rural lines are of the common-battery type, a total of 10 being provided, wired and equipped with answering and lamp jacks in position No. 5 and multipled throughout the switchboard. Toll lines are of the ring-up lamp signal relay type, a total of 10 being wired and equipped, located and multipled through positions 2, 3 and 4.

Positions 2 to 4 inclusive are each wired and equipped with 10 toll-to-toll, and toll-to-local cord circuits, with double lamp supervision four-party, manual ringing on calling cord and single-party ring-back keys wired to a four-party master key.

The cord circuits automatically adapt themselves to the different classes of service, the calling side of the circuits being further equipped for a flashing supervisory lamp recall when used on a common-battery line circuit.

Positions 5 to 11 are each wired and equipped with 17 common-battery cord circuits, each arranged for four-party machine ringing on the calling cord; keyless listening, with seizure recall key; secret service; flashing recall on the answering cord, and double lamp supervision.

1, Chief Operator's Desk; 2, Wire Chief; 3, Terminal Room; 4, Exchange Building; 5, Power Room; 6, Manager T. W. Atchison and His Daughter; 7, Operators' Rest Room. Views of the Alton Exchange.

These positions are also equipped with ringing tone to the calling subscriber while ringing out on the calling cord; manual listening on the calling cord when used on an outgoing trunk line; generator cut-off, when subscriber connected to the answering cord restores the receiver to the hook of the telephone instrument in case the subscriber being rung does not answer; and measured service meter register.

Each equipped position is also equipped with breastplate type operator's sets and pilot circuits.

The terminal room equipment is complete with main distributing frame, arrestors, arrestor pilots, and heat-coil alarm circuits, relay rack and cable support racks.

For the supervising of the switchboard a two-position sanitary type chief operator's desk has been provided, complete with operator sets, trunks, listening and monitor taps, two-way lines, service taps, desk lines, cord circuits and night alarms.

The wire chief's desk, (also two positions) is similar in design to the chief operator's desk, and is complete with all necessary apparatus to make tests on all lines and trunks.

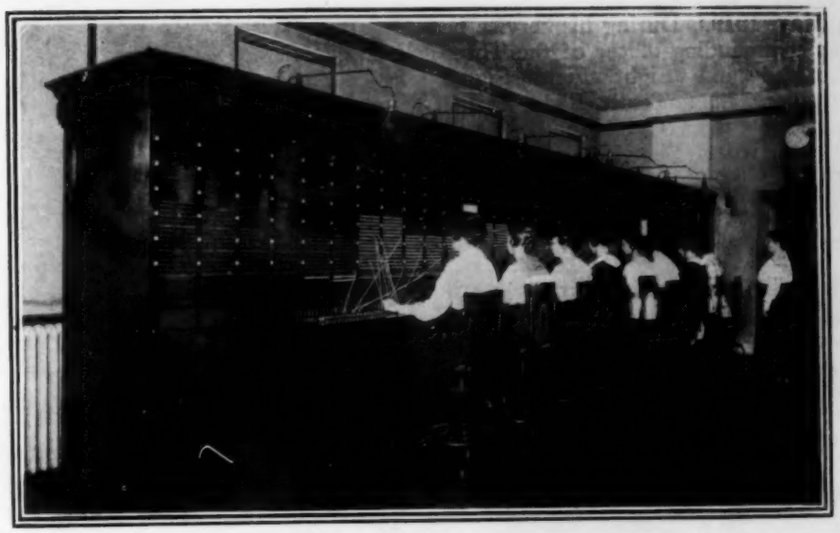
All apparatus is designed to operate on 48 volts. Power equipment consists of two sets of storage battery, having 22 cells each, the elements being placed in lead-lined tanks, the batteries being charged by a rectifier or a motor generator charging set, the latter mounted on a slate-top machine pier. Pole changing ringing sets furnished deliver frequencies of 33, 54, 66 and 16 cycles.

The interrupters for the machine ringing and flash feature of the cord circuit consist of one set operating from 110 volts, 25-cycle, single-phase alternating current and an auxiliary set to operate from 22 cells of storage battery.

A power board of slate complete with switches, circuit breakers, and meters for the control of power equipment has been installed.

The accompanying views give the reader some idea of the interior and exterior of Alton's new exchange. Fig. 1 shows the chief operator's desk, positioned so that she has a complete view of the entire switchboard.

F. X. Rivet, wire chief, is seen at his post in the second view, and the excellent arrangement of the terminal room with plenty of space for getting around connections is shown in Fig. 3.



The New Switchboard Just Installed at Alton, Ill., by the Kellogg Switchboard and Supply Company for the Kinloch Long Distance Telephone Company.

Fig. 4 shows an exterior view of the Alton exchange and Fig. 5 shows the power room. It will be observed that all the wires are run through conduit, making a practical and neat appearing job.

Fig. 6 shows Manager Atchison diverting his mind from his work for a few minutes' visit with his little daughter.

Fig. 7 is of the cozy and inviting operators' rest room which adjoins the operating room.

Mr. Atchison has worked hard in building up this exchange and is proud of his present equipment, and the standing of his company. Complaints are rare and every one seems highly pleased with the service.

Gustav Hirsch Reopens Engineering Office.

With a wealth of valuable experience back of him, Gustav Hirsch has opened an office as general consulting engineer in the Hartman Building, in Columbus, Ohio. In addition to being one of the recognized telephone engineers in the country, Hirsch has made a name for himself in factory construction and lighting. One of his pet theories is that the manufacturer of today who is wise, sees to it that his plant is scientifically lighted, in order that labor, now higher than ever, can get out the maximum production. He is an efficiency engineer who really gets efficiency.

After graduating from the Ohio State University in 1897 with the degree of M. E., he went to work for the Cleveland Electric Illuminating Company, until the war with Spain broke out. He served through the war with Spain as second lieutenant, U. S. V. Signal Corps, being mustered out in June, 1899, at which time the Citizens Telephone Company had begun to build in Columbus.

He obtained a position with the Columbus Citizens Telephone Company as draftsman and afterwards was made resident engineer, remaining with the Columbus Citizens Telephone Company until May, 1901, when he became chief engineer of the Detroit Peoples Telephone Company, which was building in Detroit and Jackson, Mich. From Detroit he went to Jackson and completed the building of that property, and later as chief engineer of the Michigan Telephone Construction Company, built a plant at Springfield, Mo.

In 1903, with Arthur W. Hoge, Hirsch formed the Ideal Construction Company, which from 1903 to 1908 did a large amount of engineering and construction work throughout the United States, principally in Ohio, Indiana, Illinois, Kentucky and Tennessee.

Since 1903 Hirsch has been consulting and chief engineer of the Lima Telephone and Telegraph Company, since 1913 consulting engineer of the Mansfield Telephone Company and the Conneaut Telephone Company, and, in addition, has done engineering and construction work in hundreds of cities throughout the United States.

In 1917 he was commissioned major in the Signal Reserve Corps, being promoted to lieutenant-colonel

in May, 1919. During his service he was commanding officer of the Three Hundred and Eight Field Signal Battalion, then Tenth Field Signal Battalion, then One Hundred and Eleventh Field Signal Battalion, and as lieutenant-colonel was divisional signal officer Thirty-sixth Division, 10 months of this service being in France.

Hirsch is a member of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, the American Association for the Advancement of Science, and the American Association of Engineers.

Examination for Telephone Engineer

The United States Civil Service Commission announces an open competitive examination for telephone and telegraph engineer. A vacancy in the office of Naval Communication Service, Navy Department, Washington, D. C., at $4,000 a year, and vacancies in positions requiring similar qualifications, at this or higher or lower salaries, will be filled from this examination, unless it is found in the interest of the service to fill any vacancy by reinstatement, transfer, or promotion.

The duties of this position require an engineer who is qualified to pass on materials, tools, and quality of service; who is familiar with wage scales and understands the organization of telegraph and telephone companies; who is familiar with cable routes throughout the world; who is competent to make detailed plans and estimates, and to supervise the installation of telegraph, telephone, and cable lines connections, and who possesses executive ability.

Competitors will not be required to report for examination at any place, but will be rated on the following subjects, which will have the relative weights indicated, on a scale of 100: (1) Education and preliminary experience, 20; (2) Responsible experience and fitness, 80.

Competitors will be rated upon the sworn statements in their applications and upon corroborative evidence.

Applicants must have had at least twelve years of engineering experience, not less than eight years of which must have been responsible work in planning, construction, and administering telegraph and telephone (local and long-distance) service. Each completed year of an engineering course in a college or university of recognized standing will be accepted as equivalent to one year of general or preliminary experience.

Indianapolis Company Sues in Merger Case

The Indianapolis Telephone Company has filed suit in the Marion Circuit Court to determine the legality of the City Council's refusal to ratify the merger of that company and the Central Union Telephone Company. The city of Indianapolis and the Central Union Telephone Company are named as defendants.

The complaint declares that in November, 1918, negotiations for the unification of the telephone systems were begun under the direction of the postmaster general. As a result of these negotiations a contract of purchase and sale was entered into by the two companies by which the Central Union was to buy all properties, real estate and equipment of the Indianapolis Telephone Company for $4,250,000.

William Fortune, president of the Indianapolis company, accepted these terms, and on a joint application of the two companies the Public Service Commission approved the purchase and sale July 7. The commission at that time ordered the Central Union to complete a unification of the lines and make connections at the earliest possible date. The City Council then refused to approve the sale and the complaint declares that this action caused the Central Union to refuse to conclude the contract because disapproval of the council creates a cloud on the titles of the property concerned.

The plaintiff company contends that ratification of the council is not necessary, as the Shively-Spencer Utility Commission act of 1913 Indiana Legislature took control of certain public utilities out of the hands of the council and vested it in the commission, which was created at this time.

It is further contented that on July 21 both telephone companies entered into a contract with the city, by which the Indianapolis Telephone Company agreed to surrender to the Central Union Telegraph Company all franchise rights granted by the city. Formerly each company had been paying the city $3,000 annually for these rights and the Central Union Company agreed to pay $6,000 annually until July 1, 1938, in order not to cause loss to the city by the merger. This agreement was signed by Mayor Jewett, members of the board of works and the presidents of the two companies, but has not been ratified by the council.

The complaint asks for the specific performance of the contract of sale by the Central Union Company, and that the court remove the cloud on titles of the property in question which was created by the assertion of the city that it has a voice in the proposed merger.

Construction Cost Was $65, Now $165 a Mile

Speaking before the convention of the Illinois Independent Telephone Association, Dr. J. B. Schwartz, of Jerseyville, secretary-treasurer of the Jerseyville Telephone Company and chairman of the press committee of the association, pointed out the fact that the cost of extending service construction in rural districts has increased from $65 per mile to $165, and in some instances to $175 per mile.

In regard to the fixing of rates for service he called attention to the fact that the state convention of Indiana has recently fixed the cost of service to subscribers on a mileage basis, that is the cost will be proportionate to the distance of the subscriber from the central exchange.

Veterans Make Good With Telephone Company

Less than one per cent of the Michigan men who served overseas or in the training camps in this country during the war and who have applied for positions with the Michigan State Telephone Company, were rejected because of physical defects, according to a report by Dr. B. Hasner, medical director for the company, and head of its extensive medical and physical research department.

Hundreds of the veterans, many of whom had never before served the telephone company in any capacity, have applied for positions.

Department heads have found, it is declared, that young men of this class those who served the nation during the emergency, are dependable and can be entrusted with almost any work.

Half-Million Dollar Merger in Southern Indiana

Telephone properties in southern Indiana which are owned by L. C. Griffitts, of Seymour, and his associates, will be taken over by a new company to be known as the Southern Indiana Telephone & Telegraph Company, capitalized at $500,000. The new company will be the largest telephone corporation in southern Indiana.

The following are the companies and the amounts the petitioners propose to pay for each: Home Telephone Company of Brownstown, $32,000; Scott County Telephone Company of Scottsburg, $31,000; Sevmour Mutual Telephone Company of Seymour, $80,000; Butlerville Telephone Company of Butlerville, $1,500; North Vernon and Vernon Telephone Company of North Vernon, $42,000; Home Telephone Company of Bicknell $32,500; Jennings County Telephone Company $14,000, and the Lexington and Little York Telephone Company, $7,000.

The petitioners also ask authority to issue $300,000 in common stock to cover the purchase price of the various companies and to issue $200,000 in 7 per cent preferred stock and $45,000 in 7 per cent short term notes. The companies affected also filed petitions for permission to sell.

The new company will control about 6,000 telephones. It is stated that the new company will establish headquarters in Seymour.

Brevities of the Business

The Activities of the Whole Telephone Field Told in Short Paragraphs

ALABAMA

Under Burleson-made rates the Southern Bell Telephone & Telegraph Company is losing money in Alabama, according to a financial statement submitted with the Alabama Public Service Commission for the perusal of the commission before it decides whether to permit continuance of the rates. Inability to get new supplies with which to increase service is said to be responsible for the monthly loss. Orders for 5,000 new phones in Birmingham and hundreds in other places cannot be taken care of, the statement shows.

ARKANSAS

Protests against the increase in rates asked by the Arkansas Telephone Company at Piggott have been made by numerous telephone subscribers. All the farmers on a line near this city have declared that they will have their phones removed if the advance is granted to the company by the State Corporation Commission and it is reported that many other patrons have determined to do likewise. The utilities company desires an advance of 50 cents a month on each telephone in the system, which extends from Marmaduke to St. Frances.

For several months a large crew has been engaged in enlarging the plant and equipment of the local Southwestern Bell Telephone Company at Helena in extending many thousands of feet of new cable and installing new phones. It is understood the construction work will have been completed by the first of the year.

ILLINOIS

The Pitcher Telephone exchanges at Stockton, Warren, Elizabeth and Hanover passed into the control of the Freeport subsidiary of the Bell Company recently. Local capitalists have been negotiating for the Pitcher interests but the deal with the Bell Company nipped the project.

A petition to the public utilities commission has been circulated among the patrons of the Wabash Valley Telephone Company in Paris and Chrisman stating that the telephone company could not continue its present service without an increase in rates, or make improvements in the property and service. The petition agrees that if the public utilities commission, after an investigation, finds the facts to be as represented, that a reasonable advance should be made in the rates in keeping with the increase in labor and cost of material. In Paris the petition was presented to 415 persons and 408 signed, including the mayor and city council and all county officials and practically all the business men. In Chrisman the petition was presented to 84 persons and all 84 persons signed, including practically all of the business men of the town.

After doing business in Springfield for eighteen years the Interstate Independent Telegraph and Telephone Company has turned over its equipment to the Central Union Telephone Company which lately purchased the rights and property of its competitor.

The Moweagua Farmers' Mutual Telephone Company of Moweaqua has been granted a charter by Secretary of State, Emerson. The company will operate a mutual telephone system for general public without charge. The incorporators are R. E. Wetzel, W. P. Sarner, Robert F. Wanley, J. Will Workman, M. S. Ayres, A. M. Burgener and Jacob Bilyeu, all of Moweaqua.

Dr. W. W. Mercer has purchased the Deer Creek telephone exchange of L. M. Norris, the deal including both the lines and buildings. Mr. Norris has been in charge of the telephone system for eleven years. He purchased from W. W. Miller.

In Illinois alone, the securities of public utility companies are held by 230,000 persons. The utility companies give employment directly to 193,700 wage-earners and indirectly to about 154,000 more. These security holders and wage-workers with their families constitute about one-third of all the people of the state. The investment of electric, gas, telephone and traction lines in the state all amounts to $1,024,000,000 and is constantly being added to to keep pace with the requirements for service.

INDIANA

George W. Dorrel, owner of the Hope and Hartsville telephone systems, has installed a toll station in the Hope exchange, which is proving a valuable acquisition to the system and its patrons.

Present telephone rates of the Central Union Telephone Company will continue in effect in Indiana until the public service commission has made a finding on the petition for an increase in Indianapolis. About thirty cities and towns are provided with telephone service in Indiana by the Central Union Telephone Company.

Indianapolis is going to have back its pre-war telephone rates "or about thirty thousand telephones are coming out." This is the ultimatum of the Telephone Patrons' Union, styled the "Anti-Gouge Society."

The Turman Township Mutual Telephone Company, with headquarters at Graysville, has received authority from the public service commission to increase its rates from $1 to $1.25 a month.

A petition asking permission to increase its rate was filed with the Public Service Commission of Indiana by the Monticello Telephone Company of this city recently. The petition states that the increase is necessary to meet the necessary operating and maintenance expenses, depreciation, contingent emergencies and a reasonable return upon the capital actually and necessarily invested.

The Lucerne Co-operative Telephone Company has been organized by farmers of Harrison and Bethlehem townships, Cass county. The officers of the organization are Mathew Maroney, chairman; Melvin Tucker, vice chairman; Ira Phillips, secretary, and Ira Maudlin, treasurer. The company is composed of patrons of the Logansport Home Telephone Company who discontinued their relations with the old concern when the new rates were asked. This is the second independent telephone company that has been organized in this county within the last six months.

Announcement was made recently of the organization of the Southern Indiana Telephone and Telegraph Company, with a capitalization of $500,000, which will take over the telephone system in Seymour and the other properties in southern Indiana under the control of L. C. Griffiths and associates.

Installation of a modern, up-to-the-minute telephone switchboard is soon to be made by the Home Telephone Company at Wabash. While the equipment now in use is modern, it lacks many of the very latest inventions and conveniences.

Telephone systems in Seymour controlled by L. C. Griffiths and associates, are to be taken over by a new company, known as the Southern Indiana Telephone and Telegraph Company, as soon as the transfer is approved by the Indiana public service commission. The new company, of which Mr. Griffiths will be president, is to be incorporated for $500,000.

J. T. Detchon of New Richmond and Max F. Rosea of Indianapolis have bought the controlling interest in the Home Telephone Company of Noblesville, the consideration being $60,000.

Mutual Telephone Company of Silver Lake increased its capital stock from $30,000 to $50,000.

The Garrett Telephone Company has petitioned the Indiana public service commission for an increase in rates. The rates were increased to the present charges while the post-office department was in control during the war. The company's inventory shows a valuation of $24,000 and on this basis the commission is asked to permit an increase of $3.50 a month for individual business lines and $1.75 for residence two-party lines with other charges in proportion. The present rates, established by the government, are $3.00 for an individual business line and $1.50 for a residence two-party line.

The Telephone Patrons' Union, an organization formed to safeguard the interests of the patrons of Indianapolis telephone companies, filed articles of incorporation with the secretary of state recently. The directors of the organization are Samuel Lewis Shank, H. H. Woodsmall, M. J. Spencer, Russell B. Harrison, Joseph D. Conley, T. Ernest Maholm, Joseph P. Rolles and Samuel T. Brown.

Orders continuing in effect from Dec. 1, until further notice, the telephone rates put into effect by the federal government and legalized up to Dec. 1, 1919, by the congress in legislation providing for the return of wire systems to private control, were issued by the Indiana public service commission. The return of the telephones involves review of the major part of all telephone rates, tolls and charges in the state of Indiana. Contrary to methods adopted by many commissioners the Indiana commission adopted the plan of holding separate hearings in each town or city in which change of rates has been made so that all having interest could be heard. These hearings have been held in every section of the state recently and there still remains to be held a general hearing on toll rates. While the commission indefinitely extended the effectiveness of the so-called government rates, the order says that it is the commission's expectation "that its orders affecting not only local and toll rates but also service connection and other charges instituted will be issued shortly.

KENTUCKY

Indication that an early merger of the Cumberland and Home Telephone Companies in Louisville will be effected was given recently when Mayor George Weissinger Smith came out unequivocally for a consolidation, declaring that two telephone systems in a large city are a nuisance. Such a consolidation, the Mayor said, should be on an equitable basis and he called upon the managements of both companies to "meet, lay your cards on the table and conduct your negotiations in a manner that will result in a fair deal for every one.

"I believe it will prove more satisfactory and a saving to all classes of persons in Louisville to have one phone system and have notified the managers of both systems operating in Louisville to attempt to get together at once and bring about a merger on a fair basis," said the Mayor.

"The one-phone system prevails in most of the cities of the country and during the last six months there have been many consolidations of the two systems prevailing in larger cities into one. The latest merger, I am told, was at Kansas City when the Home people took over the Bell company, just after the Bell company had completed a fifteen-story office building. The merger in Kansas City is said to have worked out with great satisfaction.

"There is some dispute as to when the franchise of the Home Telephone Company expires, but it is either in November of next year, or January 1, 1921. On that date the new contract with the Cumberland company, recently made with the city, will expire and I have informed the local managers of the two companies I would like to see them consolidate before the city is called on to make a new contract with each of them."

A force of men has arrived at Falmouth and is beginning work on the installation of a new switchboard at the office of the Citizens' Telephone Company. This will be a decided improvement when completed, enabling the operators to make connections with greater ease and permitting the installation of more phones, which is now an impossibility. The work will necessarily occupy some time, as the lines are to be in continuous operation.

The Home Telephone Company, of Louisville, are sending out bills for service at the old rate, that prevailing before the United States Telephone and Telegraph Administration took over the properties. Telephone companies in Kentucky, returned to the old rate schedule December 1, unless

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having authority to continue the new rates.

Philip S. Pogue president, said that no effort is being made just now to get through a new ordinance similar to the one granted the Cumberland Telephone & Telegraph Company, which sent out its bills at the higher rate authorized under the ordinance passed by the General Council, which Mayor Smith indicated he would sign upon his return from Frankfort today.

The Home's December rates are $2, $2.50 and $3 for residence telephones, $4 for straight business telephones and $7.50 for branch exchange lines.

Rates allowed the Cumberland under the ordinance are 50 cents a month higher.

MICHIGAN

At the annual meeting of the Reading Telephone Company, at Hillsdale, the following board of directors was elected: Dan Daley, W. T. Phelps, A. J. Harper, Leslie Bremer, Thomas Blakely, John Blair, E. R. Galloway. The directors will name a delegation to meet with the Michigan Utilities Commission in Lansing, in regard to the order concerning free service between exchanges.

The Southern Michigan Telephone Company at Three Rivers has asked permission of the Public Utilities Commission to increase its rate. The company has not asked for an increase for several years past and feels that the increased price of labor and materials demand the raise. The advance asked would affect Three Rivers as follows: Single party business phone, present rate, $36; proposed rate, $42. Two party business, present rate $30; proposed rate, $36. Single party residence, present rate, $21; proposed rate, $24. Two party residence, present rate, $18; proposed rate, $21. Four party residence, $15; proposed rate, $18.

Property damage sustained by the Michigan State Telephone Company in the recent storm amounted to approximately $200,000 officials announced. All lines have been restored. About 30 miles of poles were blown down.

William A. Badour has taken a position as manager of the Independent Telephone company's exchange in Three Rivers.

MISSISSIPPI

The Cumberland Telephone Company has taken over the Rome Telephone Company in Hattiesburg, which leaves Hattiesburg without competition in the telephone line. There are a few independent lines in this section and in eastern Mississippi, but it is believed that all will be under control of the Cumberland at an early date.

MISSOURI

Representatives of the telephone companies doing business in Missouri appeared before the State Public Service Commission recently with a general motion for a modification of the ruling of the commission, made effective December 1, under which the companies were denied the right to charge $3.50 each for installing telephones and $1 for changing the names in their directories. The companies are protesting bitterly against the order.

NEW YORK

The size of the private telephone exchange grows with the erection of every hotel or office building of any considerable proportion. The largest ever constructed is that of the Pennsylvania Hotel, New York. It occupies 3,165 square feet of floor space, having an operating room 110 feet long and 25 feet wide, a terminal room 30 feet long and 25 feet wide, a rest room 23 feet by 25 feet and a locker and washroom 30 feet by 14 feet. The operating force consists of one chief operator, one assistant chief operator, eight supervisors and 110 attendants. The switchboard consists of 23 positions. Thirteen positions are equipped with telautographs used for paging and announcing only. The switchboard has a capacity of 3,340 extensions and 180 trunks. The hotel has telephone service in each of its 2,200 rooms, and there are 40 public telephone booths served by four switchboards, connected with the main switchboard. The following gives some idea of a few of the items which make up part of the telephone system: Six hundred and thirty fuses, 1,170 condensers, 2,400 relays, 5,350 lamps, 83,500 jacks, 750,000 soldered connections, 7,926,000 feet of wire.

NORTH CAROLINA

The secretary of state today issued charters to the Mebane Home Telephone Company, Mebane, Alamance County, to take over the partnership of the same name, authorize capital stock $50,000.

OHIO

Metered telephone service in Cleveland will be abolished and an automanual system installed if the recommendation of the city telephone expert is followed.

The Citizens' Telephone Company, of Sheboygan, will make extensive additions to its system in this city, estimated to cost $85,000.

TENNESSEE

A saving of $51,400 annually would result from a merger of the two telephone systems in Knoxville, according to estimates of a committee of the Board of Commerce appointed by directors to endeavor to arrange for such a connection. After complete investigations the committee has ascertained that the Cumberland Telephone & Telegraph company has 6,577 stations in the city and that of this number 5,293 are exclusive stations. This leaves a remainder of 1,284 subscribers who have booth telephones.

TEXAS

The Beaumont, Texas, telephone exchange is one of the finest in the state, according to J. E. Farnsworth, of Dallas, vice-president of the Southwestern Telegraph and Telephone Company, who attended the formal opening of the new $75,000 structure recently.

The local telephone company at San Augustine is putting in, in the business part of town, the thickly populated residence sections, cables, and are otherwise greatly improving their service.

City Attorney Kenneth Krahl has recommended to Mary A. E. Amerman and the city council of Houston, that the Southwestern Telegraph and Telephone Company be ordered to discontinue the practice of service charges, which he considers is but another method of raising telephone rates. At present and for some time past the company has enforced the following service charges: $3 for moving a telephone; $3.50 for installing a telephone and $1.50 for changing a name. The city attorney points out that the city council is the ratemaking body and not the telephone company and that the company should not be allowed to increase rates by indirect methods, when the council has already declared that the company is not entitled to an increase. Mr. Krahl states that by reason of these "service" charges the revenue of the company is increased approximately $30,000 per year. These charges were put into effect by the company when it was under government control, and now that such control has been relinquished, Mr. Krahl recommends their dicontinuance. No action has yet been taken by council on the proposition.